

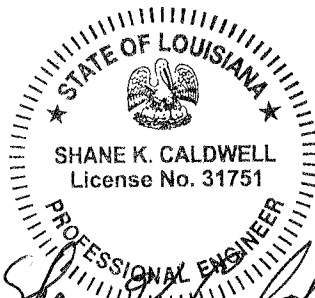
**STATE OF LOUISIANA
DEPARTMENT OF TRANSPORTATION AND
DEVELOPMENT**

CONSTRUCTION PROPOSAL



FEDERAL AID PROJECT

**STATE PROJECT NO. H.011407
DISTRICT 02H CONTROLLER UPGRADE
TERREBONNE AND LAFOURCHE PARISHES**



Shane K. Caldwell

09 February 2015

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NOTICE TO CONTRACTORS (08/14)

Electronic bids and electronic bid bonds for the following project will be downloaded by the Louisiana Department of Transportation and Development (LA DOTD) on **Wednesday, March 11, 2015**. **Paper bids and paper bid bonds will not be accepted.** Electronic bids and electronic bid bonds must be submitted through www.bidx.com prior to the electronic bidding deadline. Beginning at 10:00 a.m., all bids will be downloaded and posted online at <http://wwwapps.dotd.la.gov/engineering/lettings/>. No bids are accepted after 10:00 a.m.

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FEDERAL AID PROJECT NO. H011407

DESCRIPTION: DISTRICT 02H CONTROLLER UPGRADE

PARISHES: TERREBONNE AND LAFOURCHE

TYPE: TRAFFIC SIGNALIZATION AND RELATED WORK.

LIMITS: State Project No. H.011407: LOCATED AT VARIOUS INTERSECTIONS IN TERREBONNE AND LAFOURCHE PARISHES AS LISTED IN THE PLANS.

ESTIMATED COST RANGE: \$250,000 to \$500,000

The estimated cost range is for informational purposes only and may be subject to change. The bid prices received from bidders will be evaluated based on the actual estimate value, which will be published at bid opening, for award determination.

PROJECT ENGINEER: ONCALE, JACOB; 5056 West Main St, Houma, LA 70360; (985) 858-2422.

PROJECT MANAGER: FILLASTRE, ANDRE.

Bids must be prepared and submitted in accordance with Section 102 of the 2006 *Louisiana Standard Specifications for Roads and Bridges* as amended by the project specifications, and must include all information required by the proposal.

Prior to the electronic bid submission deadline, ONLINE BIDDER REGISTRATION for each project bid is REQUIRED. Online Bidder Registration may be accessed via the Internet at wwwsp.dotd.la.gov. Select the following options: **BUSINESS Working With DOTD**, then **Project Letting Info**, then **Online Bidder Registration**.

NOTICE TO CONTRACTORS (08/14)

When completed, a registration confirmation notice will be displayed and may be printed by the bidder. When approved for bidding, the bidder's name will be placed on the "List of Prospective Bidders" located on the LA DOTD Internet website. **It is the bidder's responsibility to review the "List of Prospective Bidders" to ensure approval to bid.** If a bidder does not register for a project, the bid will not be accepted by LA DOTD. As per Subsection 102.04(e) of the 2006 edition of the *Louisiana Standard Specifications for Roads and Bridges*, no bidders will be approved for bid registration within 24 hours before the bid opening. All bidders must register to bid before that deadline. If further information is required, please contact Mr. Alfonzo Simon, email: Alfonzo.Simon@la.gov, (225) 379-1111, fax : (225) 379-1857.

Plans and proposals are available in electronic format ONLY. All Plans, Proposals, Addenda, Amendments, Letters of Clarification, and Withdrawal Notices will be posted online. **Paper notices will not be distributed.**

Construction proposal information may be accessed via the Internet at wwwsp.dotd.la.gov. From the LA DOTD home page, select the following options: **BUSINESS Working With DOTD**, then **Project Letting Info**. Once the **Construction Letting Information** page appears, find the **Notice to Contractors** box. From the drop down menu, select the appropriate letting date and press the "Go To" button to open the page, which provides a listing of all projects to be let and a **Construction Proposal Documents** link for each project. All project specific notices are found here. **It will be the responsibility of the bidder to check for updates.** Additionally, plans and specifications may be seen in Room 100-A of the LA DOTD Headquarters Building, 1201 Capitol Access Road in Baton Rouge, LA or at the Project Engineer's office. Upon request, the Project Engineer will show the project site.

All questions concerning the plans shall be submitted via the Electronic Plans Distribution Center known as **Falcon**. All submitted questions will be forwarded by email to the Project Manager and the Project Engineer. Questions submitted within 96 hours of the bid deadline may not be answered prior to bidding. Falcon may be accessed via the Internet at wwwsp.dotd.la.gov. From the home page, select **BUSINESS Working With DOTD**, then select **Project Letting Info**. On the Construction Letting Information page, select the link, **DOTD Plans Room (Falcon)**; Login to Falcon (or request an ID if a first-time user). Once logged in, you will have access to view Project Information, submit a question concerning the project, and view the plans. To avoid any suggestion that a potential bidder is using the Falcon system to communicate with other potential bidders, DOTD will not post any question or any statement of fact or opinion not made for the purpose of seeking clarification of plans and/or specifications. Any non-questions posted on falcon will be limited to the statement of an issue considered unresolved by a previous DOTD response.

NOTICE TO CONTRACTORS (08/14)

Bidders assume the responsibility for accessing the Apparent Bid Results and final Bid Results on the Construction Letting Information web page located at wwwapps.dotd.la.gov/engineering/lettings/ to confirm whether they are the apparent low bidder for any given project and the specific due date of Form CS-6AAA. **Apparent Low Bidders on Disadvantaged Business Enterprises (DBE)/Small Business Element (SBE) Goal Projects shall comply fully with the “Required Contract Provisions for DBE/SBE Participation in Federal Aid Construction Contracts (DBE/SBE Goal Project)” contained in Section “G” of the Proposal; and, in accordance therewith, Apparent Low Bidders shall submit the completed Form CS-6AAA and Attachments to the LA DOTD Compliance Programs Office.** The award of the contract will be electronically submitted to the successful low bidder on each project.

The U. S. Department of Transportation (DOT) operates a toll free "Hotline" Monday through Friday, 8:00 a.m. to 5:00 p.m., Eastern Time. Anyone with knowledge of possible bid rigging, bidder collusion, or other fraudulent activities should call 1-800-424-9071. All information will be treated confidentially and caller anonymity will be respected.

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GENERAL BIDDING REQUIREMENTS (08/06): The specifications, contract and bonds governing the construction of the work are the 2006 Edition of the Louisiana Standard Specifications for Roads and Bridges, together with any supplementary specifications and special provisions attached to this proposal.

Bids shall be prepared and submitted in accordance with Section 102 of the Standard Specifications.

The plans herein referred to are the plans approved and marked with the project number, route and Parish, together with all standard or special designs that may be included in such plans.

The bidder declares that the only parties interested in this proposal as principals are those named herein; that this proposal is made without collusion or combination of any kind with any other person, firm, association, or corporation, or any member or officer thereof; that careful examination has been made of the site of the proposed work, the plans, Standard Specifications, supplementary specifications and special provisions above mentioned, and the form of contract and payment, performance, and retainage bond; that the bidder agrees, if this proposal is accepted, to provide all necessary machinery, tools, apparatus and other means of construction and will do all work and furnish all material specified in the contract, in the manner and time therein prescribed and in accordance with the requirements therein set forth; and agrees to accept as full compensation therefore, the amount of the summation of the products of the quantities of work and material incorporated in the completed project, as determined by the engineer, multiplied by the respective unit prices herein bid.

It is understood by the bidder that the quantities given in this proposal are a fair approximation of the amount of work to be done and that the sum of the products of the approximate quantities multiplied by the respective unit prices bid shall constitute gross sum bid, which sum shall be used in comparison of bids and awarding of the contract.

The bidder further agrees to perform all extra and force account work that may be required on the basis provided in the specifications.

The bidder further agrees that within 15 calendar days after the contract has been transmitted to him, he will execute the contract and furnish the Department satisfactory surety bonds.

If this proposal is accepted and the bidder fails to execute the contract and furnish bonds as above provided, the proposal guaranty shall become the property of the Department; otherwise, said proposal guaranty will be returned to the bidder; all in accordance with Subsection 103.04.

MANDATORY ELECTRONIC BIDS AND ELECTRONIC BID BONDS SUBMISSION (03/14): This project requires mandatory electronic bidding. All Specifications, whether Standard, Supplemental or Special Provisions, are hereby amended to delete any references regarding paper bids and the ability to submit paper bid forms.

The contractor shall register online to be placed on the Louisiana Department of Transportation and Development (LA DOTD) prospective bidders list or for information only list.

Modifications to proposal documents will be posted on the Department's website at the following URL address: <http://wwwapps.dotd.la.gov/engineering/lettings/>.

LA DOTD shall not be responsible if the bidder cannot complete and submit a bid due to failure or incomplete delivery of the files submitted via the internet.

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DBE/SBE PARTICIPATION IN FEDERAL AID CONSTRUCTION CONTRACTS

(10/12): This project has not been selected for a specific DBE/SBE Goal. The contractor shall meet the obligations of the Required Contract Provisions for DBE/SBE Participation in Federal Aid Construction Contracts contained elsewhere herein.

BUY AMERICA PROVISIONS (10/09): Pursuant to the "Buy America Provisions" of the Surface Transportation Assistance Act (STAA) of 1982 as promulgated by current FHWA regulation 23 CFR 635.410 and the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) amendment to (STAA), all steel and iron materials permanently installed on this project shall be manufactured, including application of a coating, in the United States, unless a waiver of these provisions is granted. Coating includes all processes which protect or enhance the value of the material to which the coating is applied. The request for waiver must be presented in writing to the Department by the contractor. Such waiver may be granted if it is determined that:

(1) The application of Buy America Provisions would be inconsistent with the public interest or;

(2) Such materials are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality.

Minimal use of foreign steel and iron materials will be allowed without waiver provided the cost of these materials does not exceed 0.1 percent of the total contract cost or \$2,500, whichever is greater; however, the contractor shall make written request to the DOTD Construction Engineering Administrator for permission to use such foreign materials and shall furnish a listing of the materials, their monetary value, and their origin and place of production.

The burden of proof for the origin and place of production and any request for waiver is the responsibility of the contractor.

Prior to the use of steel and iron materials in the project, the contractor shall furnish Mill Test Reports to the engineer for such steel and iron materials, accompanied by a certification stating that the Mill Test Reports represent the steel and iron materials to be furnished and that such materials were produced and fabricated in the United States.

Pig iron and processed, pelletized, and reduced iron ore are exempt from the Buy America Provisions.

IRREGULAR BIDS (08/14): Subsection 102.08 is hereby amended to include the following revision to section (g), and the addition of section (p):

g) If an owner (part or as a whole), registered agent, license holder, manager, organizer, or a principal officer(s) of the bidding entity is an owner (part or as a whole), registered agent, license holder, manager, organizer, or a principal officer(s) of another or the same bidding entity of a contracting entity which has been declared by the Department to be ineligible to bid for any reason.

p) If the apparent low bidder fails, neglects, or refuses to properly and timely submit if required, the Form CS-6AAA and attachments committing to meet or exceed the DBE goal and/or acceptable documentation of the bidder's good faith efforts to meet the goal. Upon any such failure, the original apparent low bidder will be declared irregular and will not be allowed to bid on the project should re-advertisement occur.

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MAINTENANCE OF TRAFFIC (11/09): Subsection 104.03 of the 2006 Standard Specifications is amended to include the following requirements.

The contractor shall provide for and maintain through and local traffic at all times and shall conduct his operations in such manner as to cause the least possible interference with traffic at junctions with roads, streets and driveways.

Between October 1 and January 31, the contractor shall maintain the highway in a condition suitable for large scale sugar cane hauling operations and prior thereto shall perform only those items which will not interfere with the condition of the highway for heavy hauling operations. During this period, the contractor shall provide all equipment and material necessary to keep the highway in satisfactory condition. If the contractor does not properly maintain the highway, the Department reserves the right to maintain same with its own equipment, labor and material and deduct costs of such maintenance from payments for the work. If it becomes necessary to suspend construction operations for heavy hauling during the sugar cane season, contract time will not be assessed for said period of suspension; however, maintenance of traffic shall be continued by the contractor during such period of suspension.

ACCEPTANCE (03/98): Subsection 105.17 is amended as follows:

Heading (a) is deleted and the following substituted.

(a) Partial Acceptance: When the contractor satisfactorily completes all work at a site, including all safety devices, signs and striping, the contractor may request the engineer to make final inspection of that portion of the project. When the engineer finds upon inspection that the portion has been completed in compliance with the contract, the Department will accept that portion as being completed and the contractor will be relieved of further responsibility for that portion and from further liability to the public.

PUBLIC CONVENIENCE AND SAFETY (03/14):

Subsection 107.07 of the Standard Specifications is amended to include the following.

The procurement of police officers for public safety during construction shall be in accordance with the Department's Policy for Use of Police Officers in Construction/Maintenance Work Zones. The Department project engineer shall determine the need for police officers to assist in controlling traffic in a particular work zone. The number of officers needed, the tasks they will perform, and their location within the work zone will vary as a function of the zone type. Police officers shall be placed at strategic locations at times during construction as determined by the Department project engineer.

The three types of law enforcement services are Police Presence, Police Enforcement and Police Traffic Control.

Police Presence is defined as the use of police officers at the beginning of the active work zone area utilizing their blue lights to gain the attention of drivers. The presence officer shall be certified by DOTD in accordance with the DOTD Policy on the Use of Police Officers in Construction/Maintenance Work Zones to only be used if the following criteria exist:

- (a) On multi-lane divided highways (interstates, etc.) where the posted speed limit is 50 mph and greater,
- (b) When there is a lane closure, and

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(c) If the Project Engineer anticipates a queue.

If all three of the above conditions do not exist, the Department does not consider a Presence officer to be necessary and will not reimburse the contractor for it.

Police Enforcement is utilized when enforcement is required to enhance the safe operation of the work zone.

Police Traffic Control is to be used in detour / diversion situations.

The Department project engineer will extend an invitation to the appropriate LSP (Louisiana State Police) Troop Commander to attend the pre-construction conference.

Prior to commencing the work on the project, the contractor shall contact the LSP Troop Commander to obtain law enforcement services of police officers during construction. If the LSP Troop is unable to provide law enforcement services for the project work zone, the LSP Troop Commander or the contractor will extend the invitation to the appropriate local law enforcement authorities.

Police officers will report directly to the contractor. However, the contractor will not have the authority to direct the placement of the police officer or the patrol vehicle in situations that are contrary to established procedures and/or could endanger the police officer. The Department project engineer will make the final determination on all issues regarding police officer responsibility in work zones.

Prior to the beginning of the shift, the contractor shall provide a daily work zone briefing to the police officer. For major changes in traffic patterns, advanced notification shall be provided to the police agency working the detail. This information should also be provided to the motoring public through the Department district and / or the LSP Troop.

The contractor shall pay for law enforcement services provided by the police officers based on the hourly wage and vehicle rate fee schedule below. The Department will reimburse the contractor monthly for the incurred cost. The contractor shall furnish time record documentation with the request for reimbursement. The provisions of Subsection 109.04 shall not apply to this reimbursement.

The agreed upon fee schedule for police officers in the work zone is as follows:

Hourly Rate

\$40 per hour (maximum) per officer (one officer per vehicle) (minimum 2 hours).

This rate shall be paid per the individual police agency department policy up to \$40/hr max.

The officer may also receive 1 hr total of travel time at \$40/hr to get to and from the worksite if requested by the officer and the detail is further away from his usual domicile.

Vehicle Use Fee

\$25 per vehicle per day - vehicle use fee (if this individual police agency department policy exists)

If the vehicle is parked on the detail or 49 or less miles are accrued, the vehicle charge is \$25 (stationary operation). If the vehicle is driven 50 miles or more during the detail (moving operation), the charge is determined by the number of miles driven in accordance with the following table:

<u>Chargeable Miles</u>	<u>Fee</u>
0 - 49 miles	\$25.00
50 - 99 miles	\$50.00

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100 - 199 miles	\$75.00
200 - 299 miles	\$100.00
300 miles and over	\$125.00

Mileage to the detail or return mileage shall not be included in the vehicle use fee.

CONTRACTOR'S RESPONSIBILITY FOR WORK (07/09): Section 107 Legal Relations and Responsibility to Public of the 2006 Standard Specifications is amended as follows:

Subsection 107.19, Contractor's Responsibility for Work is amended to delete the first paragraph of Subpart (b) and substitute the following:

Unavoidable damage due to Acts of God such as earthquake, tidal wave, tornado, hurricane, or other cataclysmic phenomenon of nature or acts of governmental authorities, except for materials and equipment that are not incorporated in the work.

PROSECUTION OF WORK (06/13): Subsection 108.04, Prosecution of Work of the Standard Specifications as amended by the supplemental specifications thereto, is deleted and replaced by the following.

108.04(a) General

The contractor shall provide sufficient materials, equipment, and labor to complete the project in accordance with the plans and specifications within the contract time. If the completed work is behind the approved progress schedule, the contractor shall take immediate steps to restore satisfactory progress and shall not transfer equipment or forces from uncompleted work without prior notice to, and approval of, the engineer. Each item of work shall be prosecuted to completion without delay. If prosecution of the work is discontinued for an extended period of time, the contractor shall give the engineer written notice at least 24 hours before resuming operations.

108.04(b) Progress and Disqualification

The contractor's progress will be determined monthly at the time of each partial estimate, and will be based on the total amount earned by the contractor as reflected by the partial estimate. If the contractor's progress is more than 20 percent behind the elapsed contract time, the contractor may be notified that he is not prosecuting the work in an acceptable manner. If requested by the Department the contractor must meet with and provide the project engineer with an acceptable written plan which details how the contractor will regain lost progress and prosecute the remaining work.

A contractor shall be immediately disqualified when, on two or more projects, the contractor is in default in accordance with Subsection 108.09(a) and its progress on each such project is deficient by 10 percent or more. The contractor shall remain disqualified until only one overdue project remains incomplete and it has achieved final acceptance of the other project(s).

Should the surety or the Department take over prosecution of a project, the contractor shall remain disqualified for a period of one year from the completion of the project, unless the contractor is debarred.

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A contractor may also be disqualified for other causes as provided elsewhere in the contract. During the period of disqualification, except as provided elsewhere, the contractor will not be permitted to bid on Department contracts nor be approved as a subcontractor on Department projects. Any bid submitted by the contractor during the period of disqualification will not be considered and will be returned.

108.04(c) Disqualification Review Board

After disqualification, the contractor may submit a written appeal to the Chief Engineer on construction projects, the Assistant Secretary, Office of Operations, on maintenance projects, or the District Administrator on district-let contracts for review by the appropriate Departmental Disqualification Review Board. The written appeal shall be submitted within 7 days, excluding weekends and holidays, after issuance of written notice of disqualification and the contractor may either request a meeting with the review board or that the review board consider a written appeal only. A meeting of the review board will be scheduled within 5 days, excluding weekends and holidays, after receipt of appeal.

The Department's headquarters review board will be composed of the Chief Engineer, or his designee, and five other members appointed by the Secretary. The Chief Engineer, or his designee, and two other members will constitute a quorum.

After all pertinent information has been considered, the contractor will be notified of the decision of the review board in writing within 5 days, excluding weekends and holidays. The decision of the review board will not operate as a waiver by the Department of its rights concerning the assessment of stipulated damages as specified under 108.08.

When the Department of Transportation and Development is not the contracting agency on a project, the contracting agency will make any disqualification determination and the contractor shall submit its appeal to the appropriate agency representative for that agency to address. The contracting agency will request that the Department concur with their decision prior to notifying the Contractor in writing. The DOTD's concurrence is advisory and will not make the DOTD a party to the contracting agency's construction contract.

PAYMENT ADJUSTMENT (05/06): Section 109, Measurement and Payment of the Standard Specifications is amended to add the following.

This project is not designated for payment adjustments for asphalt cements or fuels.

TEMPORARY TRAFFIC CONTROL (01/13): Section 713, Temporary Traffic Control of the 2006 Standard Specifications, and the supplemental specifications thereto is amended as follows:

Subsection 713.02 Materials is amended to substitute the following:

(b) Reflective Sheeting: Reflective sheeting requirements for temporary signs, barricades, channelizing devices, drums and cones shall comply with the following:

Section 1015.05(g).

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TRAFFIC CONTROL MANAGEMENT (03/14): Subsection 713.08 of the 2006 Standard Specifications and the supplemental specifications is deleted and replaced with the following:

713.08 TRAFFIC CONTROL MANAGEMENT.

(a) Authorization: Prior to commencing work requiring traffic control management, the contractor shall submit to the engineer proof of the Traffic Control Supervisor's (TCS) and Traffic Control Technician's (TCT) current authorizations.

The Department will accept the TCS authorization of other approved agencies or firms only if all of the following minimum TCS requirements are met:

- (1) Successful completion of a work zone traffic control supervisor course approved by the Department.
- (2) Passing a written examination on the work zone traffic control supervisor course.
- (3) A minimum of one (1) year full-time field experience, verified by the agency or firm, in work zone traffic control. This experience may be verified by the Department at its discretion.
- (4) A TCS refresher course is required every four (4) years.

The Department will accept the TCT authorization of other approved agencies or firms only if all of the following minimum requirements are met.

- (1) Successful completion of a work zone traffic control technician course approved by the Department.
- (2) Passing a written examination on the work zone traffic control technician course.
- (3) A TCT refresher course is required every four (4) years.

(b) Traffic Control Supervisor (TCS) Duties: The TCS's responsibility shall be traffic control management, and the TCS shall be available to the engineer to address traffic control management issues as needed. The following is a listing of the TCS's primary duties:

(1) The TCS shall personally provide traffic control management and supervision services at the project site. The TCS may have other assigned duties, but shall be readily available at all times to perform TCS duties as required in the contract. A minimum of one (1) TCT or TCS shall be required on site during working hours, except the following where a TCS shall be onsite at all times during working hours:

- freeways, expressways, and interstates
- multilane roads with posted speeds of 45 mph and greater
- other roadways with ADT equal to and greater than 25,000.

(2) The TCS shall be responsible for observing and evaluating both the day and night time performance of all traffic control devices installed on the project, in accordance with the Traffic Control Plan (TCP), to ensure that the devices are performing effectively as planned for both safety and traffic operations. This shall be done upon the initial installation of the devices and when any modifications and/or changes are made, in addition to the inspection of traffic control required in Heading (e).

(3) The TCS shall be responsible for revisions requested by the contractor to the traffic control plan established in the contract and shall submit the new traffic control plan in accordance with Heading (c).

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(4) The TCS shall be responsible for the training of flagging personnel. This training will ensure that all flagging done on the project is in compliance with the MUTCD Part VI and Louisiana Work Zone Traffic Control Details. Flaggers shall be re-qualified every four (4) years.

(5) The TCS shall coordinate all traffic control operations for the duration of the contract, including those of subcontractors, utility companies, and suppliers, to ensure that all traffic control is in place and fully operational prior to the commencement of any work. The Department recognizes that the contractor does not have direct control over the traffic control operations of the utility companies. The coordination provided by the TCS when dealing with utility companies is specifically for the purpose of coordinating concurrent utility traffic control with any other construction traffic control to avoid conflicts.

(6) The TCS shall coordinate, in writing, all project activities with the appropriate law enforcement, fire control agencies, and other appropriate public agencies as determined at the pre-construction conference by the engineer. The TCS shall also invite the above agencies to the pre-construction conference.

(7) The Department in collaboration with the TCS, shall prepare and submit statements concerning road closures, delays, and other project activities to the news media on a weekly basis or more often as needed. News releases shall be submitted to the engineer for review and approval prior to the District's submittal to the news media.

(8) The TCS shall be responsible for notifying the engineer, or designee, immediately of all vehicular accidents and/or incidents related to the project traffic control. The time and date of notification shall be documented in the traffic control diary. The TCS shall also monitor and document queues that occur as necessary.

(9) The TCS assigned to the project shall attend the pre-construction conference and all project meetings.

(10) The TCS shall be responsible for the maintenance, cleanliness, replacement and removal of traffic control devices of the existing traffic control plan during working and non-working hours.

(c) Traffic Control Plan Revisions: Requests for revision in the traffic control plan must be made in writing to the engineer a minimum of fourteen (14) calendar days in advance of the needed revision. If the requested revision falls within the scope of the existing contract drawings, the engineer may approve the revision. If the engineer determines that the requested revision is outside the scope of the contract drawings, the contractor will be required to submit a change order. The change order drawings shall conform to the following:

(1) Letter size original contract drawings --The change order drawings shall be submitted on high quality white 8 1/2 x 11 inch letter size paper. The drawings may be hand drafted or computer drafted and arranged in landscape format on the page. The text and drawings must be legible after reproduction on standard reproduction equipment. Left, bottom and right hand margins shall be at least 1/2 inch and the top margin shall be one (1) inch.

(2) Full size original contract drawings -- The change order drawings shall be submitted on high quality, 4-mil, double-matte film using a plotting or reproduction process that fuses the graphics to ensure durability. Repeated handling and friction due to stacking of plans shall not smear, flake or rub off the graphics. Improper plotter settings and plotter wear may cause inconsistent durability of the drawings. The contractor shall test samples of the submitted drawings for durability. Advance samples of matte films may be submitted for approval;

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however, the contract plans will be tested separately. Failures will result in rejection of the submittal. Drawing sizes shall be in accordance with Subsection 801.03(a).

Lettering on change order drawings shall be of adequate size to facilitate a fifty (50) percent reduction of plans. Additions or changes shall be made with a permanent type of waterproof ink made for this purpose. If revised cross sections are required, the cross-sections shall be plotted on standard plate cross-section sheets. The ground line, centerline elevation, and station numbers, as a minimum, shall be drawn in ink; the remaining information may be in pencil.

Regardless of size, all change order drawings and documents required shall be identified with the DOTD project title and project number. All plans and calculations shall be signed and sealed by a professional civil engineer currently registered to practice in Louisiana.

All plans submitted by the contractor shall conform to these specifications and standards. The DOTD Chief Engineer may reject any plans not conforming to these standards.

Revisions to the TCP that are determined to be outside the scope of the original contract drawings must be approved by the DOTD District Traffic Engineering Division prior to implementation of the requested revision. In some cases on high traffic routes or high priority projects, the revisions must be approved by the HQ Traffic Operations Engineer.

(d) Traffic Control Diary: The TCS shall maintain a project traffic control diary using the Department's Site Manager Program. The TCS shall be responsible, as a requirement of item 713, to keep the traffic control diary current on a daily basis and shall electronically sign each daily entry. A date stamp will appear on each diary, so it is imperative that these diaries be completed in a timely manner. Completion and maintaining of the daily diaries in accordance with the plans and specifications is subject to the Louisiana "Filing or Maintaining False Public Records" Law. Photographs and videotapes may be used to supplement the written text.

The traffic control diary shall be available at all times for inspection by the engineer. Failure to complete the diary on a daily basis shall result in a deduction of \$150 per day, from monthly estimate payments for the work, as stipulated damages for each day the diary is not completed or maintained. On days when the Department's Site Manager Program is unavailable, either due to location or operation, the TCS will be required to make arrangements with the approval of the Project Engineer to submit the TC diaries daily. Submitted diaries that indicate contemporary daily record keeping has not been maintained, as determined by the engineer, the Department's Work Zone Engineer or the Department's Statewide Traffic Control Specialist, shall result in a deduction of \$150 for each calendar day from the monthly estimate payments for the work. The traffic control diary is part of the pay item 713 and shall become the property of the Department at the completion of the project.

The contractor, with the approval of the engineer, the Department's Work Zone Engineer, or the Department's Statewide Traffic Control Specialist, may cease the requirement of a traffic control diary when:

- 1) The project has been partially accepted and/or no remaining work exists on the project site that impacts the traveling public or
- 2) When all signs and barricades are removed at the conclusion of the project.

(e) Inspection of Traffic Control: The TCS shall be responsible for the inspection of all traffic control devices every calendar day that traffic control devices are in use. This inspection may be delegated to the TCT, except per the conditions described in (b)(1) above, where the TCS shall conduct the inspections himself. Regardless, the TCS shall be stationed within one (1) hour of the jobsite.. The "Quality Guidelines for Work Zone Traffic Control

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Devices” standard by the American Traffic Safety Services Association (ATSSA) shall be used to evaluate the condition of the traffic control devices to determine if acceptable for use. The TCS shall provide for the immediate repair, cleaning, or replacement of any traffic control devices not functioning as required to ensure the safety of the motorist and construction personnel and/or not meeting the ATSSA standard.

Inspection of the traffic control devices shall be conducted by the TCS at the beginning and end of each workday, and as scheduled or directed by the engineer during the workday. The traffic control devices shall be inspected by the TCS on weekends, holidays, or other non-work days at least once per day. Traffic control devices shall be inspected by the TCS at least once a week during nighttime periods and the same night after any modifications or changes have been made in the traffic control devices.

(f) Failure to Comply: The engineer, the Department’s Work Zone Engineer, or the Department’s Statewide Traffic Control Specialist may suspend all or part of the contractor’s operation(s) for failure to comply with the approved “Traffic Control Plan” or failure to correct unsafe traffic conditions within a reasonable period of time after such notification is given to the contractor in writing. If there are major traffic control deficiencies that require immediate corrective action for the safety of the travelling public, the engineer, the Department’s Work Zone Engineer, or the Department’s Statewide Traffic Control Specialist may completely suspend the contractor’s operations. This suspension can either be verbal or written, but shall be followed up in writing as soon as practical. The Department reserves the right to revoke or de-certify the TCS for gross neglect of his or her duties. The TCS at this point shall retake a Department approved TCS course and will be subject to a ninety (90) day probationary period at the discretion of the Department.

In the event that the contractor does not take appropriate action to bring the deficient traffic control into compliance with the approved traffic control plan or to correct the unsafe traffic conditions, the Department may proceed with the corrective action using its own forces, and such costs will be deducted from payments owed to the contractor.

If the contractor’s operations are suspended, the normal assessment of contract time will not cease for the period required to correct these unsafe conditions and traffic control deficiencies. The contractor shall not be relieved of the responsibility to provide traffic control safety to the traveling public when a project is under full or partial project suspension. When a project is under suspension due to the contractor’s failure to comply with this section, or when the contract is under stipulated damages, the contractor shall continue to provide traffic control management and no additional measurement or payment will be made. If suspensions or partial suspensions are requested by the contractor, the additional traffic control management costs will be at the contractor’s expense.

(g) Engineer Modifications: The provisions included in the plans and specifications for handling and controlling traffic during construction may be changed by the engineer, with the approval of the DOTD District Traffic Operations Engineer, due to actual field conditions encountered. Such changes will be made by written instruction to the contractor and shall be considered an amendment to the plans and specifications as of the date of change.

PAINTS (03/10):

Section 1008, Paints of the 2006 Standard Specifications is amended as follows.

Subsection 1008.05, Cold Galvanized Repair Compound is amended to delete the second paragraph and substitute the following:

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Test panels coated with the compound shall be tested in a salt fog apparatus in accordance with ASTM B 117 for 1500 hours. The panels shall show no sign of rust, blistering, undercutting, delamination, or other deleterious properties when evaluated in accordance with ASTM B 117.

Subsection 1008.07, Zinc Paint Systems For New Structural Steel And 100 Percent Bare Existing Structural Steel is amended in the last table to remove the incorrect test procedure, ASTM D 2321 and replace it with the correct test method for X-Ray Diffraction and substitute the following:

X-Ray Diffraction ASTM D 5380

SIGNS AND PAVEMENT MARKINGS (06/14): Section 1015 Signs and Pavement Markings of the 2006 Standard Specifications and the supplemental specifications thereto is amended as follows:

Subsection 1015.02, Metals, is amended as follows:

The first paragraph in subsection (a)(3), Steel Posts for Small Signs, Markers and Delineators, is deleted and replaced with the following:

- (a) U-Channel: Posts shall be steel of the flanged channel type shown on the plans, galvanized after fabrication in accordance with Subsection 811.12. Before fabrication, posts shall be within 3.5 percent of the specified weight (mass).

Subsection (b) Square Tubing for Small Signs, Markers, and Delineators is added as follows:

Sign posts shall be 2 inches (50 mm) x 2 inches (50 mm) x 14 gauge perforated square tubing for the upright sign post, 2 ¼ inches (56 mm) x 2 ¼ inches (56 mm) x 3 feet (1 m) x 12 gauge for the direct drive anchor (hard soil), and a 2 ¼ inches (56 mm) x 2 ¼ inches (56 mm) x 18 inch (minimum length) x 12 gauge Omni-Directional anchor with 4 inch x 12 inch x 10 gauge wings welded to all four corners with wings conforming to ASTM A659 for the direct drive anchor (soft soil, when specified in the plans).

The square tubing shall conform to ASTM A1011, Grade 50 for hot rolled carbon steel, structural quality. The average minimum tensile strength after cold-forming is 60,000 psi (415 MPa). The cross section of the square tubing shall be a square tube formed and carefully rolled to size and shall be welded by high frequency resistance welding and externally scarfed to agree with corner radii and dimensional tolerances shown in the plans or LADOTD Roadside Traffic Sign Standard Details. It shall be manufactured from hot-dipped galvanized steel conforming to ASTM A653/A653M-10, G90, Structural Quality, Grade 50, Class 1. The weld shall be hot zinc coated after the scarfing operation. The steel shall be coated with a chromate conversion coating and a clear organic polymer topcoat.

Subsection 1015.04 Sign Panels is deleted and replaced by the following:

- (a) Permanent Sign Panels: New and Recycled flat panels shall be 0.080 inch (2mm) thick aluminum sheets or plates complying with ASTM B 209, Alloy 6061-T6 or Alloy 5052-H38. New and recycled extruded aluminum panels shall comply with ASTM B 221

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(ASTM B 221M), Alloy 6063-T6. Aluminum shall have a chromate conversion coating meeting ASTM B449 Class I or II., and after fabrication, have a flatness equal to or less than 0.031 inch per foot of length and 0.004 inch per inch of width.

(b) Temporary Sign Panels: Substrate for barricade panels shall be either wood or rigid thermoplastic. Substrate for portable signs shall be new or recycled aluminum, wood or plastic. Substrate for post mounted signs shall be new or recycled aluminum, wood, rigid thermoplastic or aluminum clad low density polyethylene plastic.

(1) Aluminum: Aluminum sheeting shall be 0.080 inch (2 mm) thickness complying with ASTM B 209 (ASTM B 209M), Alloy 6061-T6 or Alloy 5052-H38.

(2) Wood: Plywood sheeting of exterior type Grades either High Density Overlay or Medium Density Overlay, are acceptable for use provided the following requirements are met.

Panels shall be a minimum of 5/8 inch (15 mm) thick and shall comply with the latest American Plywood Association specifications and be identified with the APA edge mark or back stamp to verify inspection and testing. Prior to application of reflective sheeting, the surface shall be abraded with steel wool or fine sandpaper, and wiped thoroughly clean. The surface shall be allowed to dry a minimum of 8 hours prior to application of sheeting. Cut edges of plywood panels shall be sealed with an approved aluminum pigmented polyurethane sealer.

(3) Plastic: Plastic substrate for barricade panels and signs shall be as follows.

a. Fiber Reinforced Vinyl (PVC): The substrate shall have a nominal composite thickness of 0.04 inches (1 mm) and be bonded to an approved retroreflective material by the manufacturer.

b. Rigid Thermoplastic: Rigid thermoplastic substrate shall consist of either High Density Polyethylene (HDPE) or High Density Polycarbonate (HDPC). The rigid thermoplastic for barricade panels shall be hollow core HDPE or HDPC with a minimum thickness of 0.625 inch (16 mm). The thermoplastic for sign panels shall be either 0.40 inch (10 mm) thick thin wall, fluted substrate or 0.625 inch (16 mm) thick blow molded substrate. Substrates shall be sufficiently rigid to maintain a flat face and shall be capable of attachment to the sign mounting in such a manner as not to crush or otherwise deform the substrate. Reflectorized sheeting applied to rigid thermoplastic shall have its manufacturer's approval for use on the substrate.

c. Aluminum Clad Low Density Polyethylene (AL/LDPE) Plastic: The aluminum clad low density polyethylene plastic substrate shall be 0.080 inch (2 mm) thick. The substrates shall be sufficiently rigid to maintain a flat face and shall be capable of attachment to the sign mounting in such a manner as not to crush or otherwise deform the substrate. Reflectorized sheeting applied to aluminum clad low density polyethylene shall have its manufacturer's approval for use on this substrate.

Subsection 1015.05 Reflective Sheeting is amended as follows:

The first paragraph in (a) is deleted and replaced by the following:

(a) Permanent and Temporary Standard Sheeting: Reflective sheeting shall be one of the following standard types as specified on the plans and complying with ASTM D 4956 except as modified herein. Permanent warning, regulatory, guide and supplemental guide sign sheeting shall meet the requirements of DOTD Type X as detailed below. Reflective sheeting for temporary signs and devices shall meet the requirements of ASTM D 4956 Type III except as noted in Subsection 1015.05(g). Reflective sheeting shall be an approved product listed in QPL 13.

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The first paragraph in (g) is deleted and replaced by the following:

(g) Temporary Signs, Barricades, Channelizing Devices, Drums and Cones: Reflective sheeting for temporary signs, barricades and channelizing devices, shall meet the requirements of ASTM D 4956, Type III except that temporary advanced warning construction signs used on the mainline of freeways, expressways, and interstates shall be fluorescent orange and meet the requirements of DOTD Type X.

BARRICADE WARNING LIGHTS (11/11): Section 1018, Miscellaneous Materials of the 2006 Louisiana Standard Specifications for Roads and Bridges as amended by supplemental specifications is further amended as follows.

Subsection 1018.12, Barricade Warning Lights is deleted in its entirety and the following substituted:

1018.12 BARRICADE WARNING LIGHTS.

(a) General: Unless otherwise designated in the plans, barricade warning lights shall be Type A/C (switchable combination low-intensity flashing and steady burn), Type B (high-intensity flashing), or Type D (360-degree steady burn), and all bulbs shall be LED-type. Barricade warning lights shall be Qualified Brand Name products, (QPL 16), and comply with the MUTCD.

(b) Markings: Each light submitted for approval and each light placed on a project shall have a permanently attached identification plate or other permanent markings with the following information:

- 1 Manufacturer's name
- 2 Model number
- 3 Type
- 4 Lens manufacturer and identification number
- 5 Circuit manufacturer and identification number
- 6 Bulb number
- 7 Minimum operating voltage required to conform to minimum intensity requirements
- 8 Year of manufacture

(c) Certification: Prior to installation, the contractor shall furnish the engineer with the following information:

- 1 Material certification (Certificate of Compliance)
- 2 Proposed number of warning lights to be used
- 3 Type
- 4 Trade name
- 5 Manufacturer's name and model number as contained in QPL 16

The certification shall also state that each light assembly has been tested, is functioning properly and will be maintained in satisfactory working order.

TRAFFIC SIGNALS (06/09): Section 1020, Traffic Signals of the 2006 Standard Specifications as amended by the supplemental specifications is further amended as follows.

Subsection 1020.01, Traffic Signal Heads is amended as follows.

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Heading (c), Optical Unit; Subheading (2), 12-inch (300 mm) LED Traffic Signal Lamp Unit (Mast Arm and Span Wire Mount) is deleted and the following substituted:

(2) 12-inch (300 mm) LED Traffic Signal Lamp Unit (Mast Arm and Span Wire Mount):

a. General: All LED traffic signal lamp units shall conform to the latest versions of the Institute of Transportation Engineers (ITE) Vehicle Traffic Control Signal Heads (VTCSH) LED Vehicle Arrow Traffic Signal Supplement standard, the ITE, VTCSH LED Circular Signal Supplement standard, and this specification.

The LED traffic signal lamp unit shall be designed as a retrofit replacement for existing signal lamps, which will not require any special tools for installation. The 12-inch (300 mm) retrofit replacement LED traffic signal lamp unit shall fit into existing traffic signal housings without modifications. Installation of a retrofit replacement LED traffic signal lamp unit into existing signal housing shall only require removal of the existing lens, reflector, and incandescent lamp, fitting of the new unit securely in the housing door, and connecting to existing electrical wiring or terminal block by means of simple connectors.

If proper orientation of the LED traffic signal lamp unit is required for optimum performance, prominent and permanent directional marking(s), an "UP arrow" or equivalent, for correct indexing and orientation shall exist on the unit.

The manufacturer's name, serial number, manufactured date (minimum month and year) and other necessary identification shall be permanently marked on the backside of the LED traffic signal lamp unit. A label shall be placed on the unit certifying compliance with the above ITE standards.

Any deviation to product design after testing and approval by the Department shall constitute a new model and must have a new model number. The new model must be submitted for acceptance. Random testing of average production LED traffic signal lamp units will be conducted to ensure compliance with this specification.

b. Physical and Mechanical Requirements: The LED traffic signal lamp unit shall be a single, self-contained device, not requiring on-site assembly for installation into existing traffic signal housing.

The assembly and manufacturing process for the LED traffic signal lamp units shall ensure that all internal LEDs and electronic components are adequately supported to withstand mechanical shock and vibration from high winds and other sources.

Each LED traffic signal lamp unit shall be comprised of a UV stabilized polymeric outer shell, multiple LED light sources, and a regulated power supply. LEDs shall be mounted on a polycarbonate positioning plate or PC board.

Each LED traffic signal lamp unit shall have a clear lens with the incandescent look (individual LEDs should not be directly visible). Tinted lenses are not acceptable.

c. Optical and Light Output Requirements: The LEDs shall be manufactured using Aluminum-Indium-Gallium-Phosphide (AlInGaP) technology or other LEDs with lower susceptibility to temperature degradation than Aluminum-Gallium-Arsenic (AlGaAs). AlGaAs LEDs will not be allowed.

Designs that require LEDs to be operated at currents greater than the LED manufacturer's recommended drive current will not be allowed. The color of the LED traffic signal lamp units will be shown on the plans.

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Each LED traffic signal lamp unit shall meet minimum laboratory light intensity values and light output distribution as described in ITE. VTCSHs LED Supplements for a minimum period of sixty (60) months, based on DOTD TCS 42 normal use in traffic signal operation over an operating temperature range of -40°C to +74°C.

Measured chromaticity coordinates of LED traffic signal lamp units shall conform to the chromaticity requirements detailed in the ITE standards listed in heading (a) for a minimum period of 60 months.

LED traffic signal lamp units tested or submitted for testing shall be representative of typical production units. Optical testing shall be performed with LED units mounted in standard traffic signal sections without visors or hoods attached to the signal sections.

A copy of the lab test report from an independent lab for each LED traffic signal lamp model shall include light intensity values at each ITE specific distribution test point. The lab report shall document current, voltage, and total harmonic distortion (THD) for each test point. The power factor (PF) associated with each model shall be documented.

d. Electrical: Each LED traffic signal lamp unit shall incorporate a regulated power supply that will electrically protect the LEDs and maintain a safe and reliable operation. The power supply shall provide capacitor filtered DC regulated current to the LEDs according to the LED manufacturer's specifications. Design of the power supply shall be such that the failure of an individual component, or any combination of components, cannot cause the signal to be illuminated after AC power is removed. LED traffic signal lamp units shall be operationally compatible with TS1, TS2, and 2070 controllers, conflict monitors with plus features, and malfunction management units currently used by the Department.

Circular and arrow LED traffic signal lamp units shall be designed to sense a loss of light output due to catastrophic LED failure and react in compliance with the failed state impedance provision of the ITE VTCSHs Circular Signal Supplement (latest edition).

Two, captive, color coded, 600V 18 AWG minimum jacketed wires, 3 feet (1 m) long, conforming to the National Electrical Code, rated for service at 105°C, are to be provided for an electrical connection. The LED traffic signal lamp units shall have on-board circuitry, including voltage surge protection, to withstand high-repetition noise transients and low-repetition high-energy transients as stated in Section 2.1.8, NEMA Standard TS 2-2003, except voltage shall be 2000V instead of 1000V. The DOTD TCS 42 3 of 6 OCT 2008 circuitry shall also be able to withstand high-repetition low-energy transients as stated in Section 2.1.6, NEMA Standard TS 2-2003.

e. Environmental Requirements: Environmental requirements shall meet or exceed ITE VTCSHs LED Standard Supplements (latest edition).

The LED traffic signal lamp units shall be rated for use in the ambient operating temperature range of -40°C to +74°C.

The LED traffic signal lamp units shall be dust and moisture tight to protect all internal LED and electrical components.

The LED traffic signal lamp units shall consist of a housing that is a sealed watertight enclosure that eliminates dirt contamination and allows for safe handling and operation in all weather conditions. Moisture resistance testing shall be performed on LED signal modules in conformance with the requirements in the ITE VTCSHs LED Standard Supplements. Evidence of internal moisture after testing shall be cause for rejection.

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f. Production Testing Requirements: A quality assurance (QA) program must be in place at the manufacturer's facility to ensure product reliability in accordance with ITE VTCSHs LED Standard Supplements.

Each new LED traffic signal lamp unit shall be energized for a minimum of 24 hours at nominal operating voltage (120V AC RMS) at room temperature in order to cause any electronic infant mortality to occur, and to ensure electronic component reliability prior to shipment.

g. Certifications: The contractor shall provide a copy of a test report certified by an independent laboratory accredited by the American Association for Laboratory Accreditation (A2LA) within the electrical field. The certification shall state that the LED traffic signal lamp model submitted meets or exceeds the latest ITE VTCSH LED Supplemental Standards. The laboratory report should include documentation of tests and verification of compliance to the additional provisions of this standard. Tests performed by the independent lab shall follow all the instructions documented in the latest ITE VTCSH Circular and Vehicle Arrow Traffic Signal Supplement.

h. Warranty: The contractor shall submit the contact name, address, telephone number and e-mail address or webpage for the representative, manufacturer, or distributor for warranty repair.

Manufacturer must comply with all requirements of the following warranty. The manufacturer or supplier shall submit a letter of compliance prior to the delivery of any units indicating understanding and willingness to abide by the provisions of this specification.

If requested by the Department, the manufacturer shall supply schematics for all electronics.

The manufacturer or supplier shall provide name and telephone number of the person to contact regarding potential claims under the provisions of this warranty. The compliance letter shall be addressed to:

Louisiana Department of Transportation and Development
Section 45, Traffic Operations
ATTN: Signal Engineering
7686 Tom Drive
Baton Rouge, Louisiana 70806

The LED traffic signal lamp units shall be warranted against any failure due to design, workmanship, material defects, or intensity within the first 60 months from date of delivery. LED traffic signal lamp units shall meet or exceed minimum requirements of this specification for a period of no less than 60 months from date of delivery. Repair or full replacement will be required if a LED traffic signal lamp unit fails to operate as specified under normal operating conditions. Repaired or replaced LED traffic signal lamp units will be provided at no cost to the Department. The replaced or repaired LED traffic signal lamp units will inherit the remainder of the failed LED traffic signal lamp unit's warranty. LED traffic signal lamp units shall be repaired or replaced within 5 business days after receipt of failed LED traffic signal lamp unit/s at no cost to the Department with the exception of shipping the failed LED traffic signal lamp units to the vendor or manufacturer. The cost of shipping the LED traffic signal lamp units back to the Department shall be borne by the vendor or manufacturer.

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If a LED traffic signal lamp unit fails with no visible damage to electronic / electrical components or wiring (not including fuses or components designed to act as a fuse), then the LED traffic signal unit is considered to have failed under normal operating conditions. A blown fuse or a component acting as a fuse, without any other permanent failure to electrical / electronic components shall be considered to have failed under normal operating conditions. Acts of God will not be accepted as excusable unit failures without visible damage.

The manufacturer/provider shall submit a certification document with each lot or shipment stating that the LED traffic signal lamp units provided meet all the requirements of this specification. The certification document shall show individual lot numbers and manufacture dates.

i. Quality Assurance: The Department may perform random sample testing on shipments.

Optical testing shall be performed with the module mounted in a standard traffic signal section, but without a visor or hood attached to the section housing. The number of modules tested shall be determined by the quantity of each model in the shipment. The sample size shall conform to ANSI/ASQC 21.4. DOTD Traffic Operations shall determine the sampling parameters to be used for the random sample testing. All parameters of the specification may be tested on the modules. Acceptance or rejection of the shipment shall conform to ANSI/ASQC 21.4 for random sampled shipments.

The Department reserves the right to select a sample from the field during the warranty period and perform tests to determine extended compliance and / or deterioration of the LED traffic signal lamp units.

An awarded contract may be terminated if the Department observes a 5 percent or greater unit failure rate within a period of 90 days after the units are placed into operation.

Heading (f), Backplates is deleted and the following substituted.

(f) Backplates: Backplates shall be designed to fit the combination of sections of each signal face. Backplates shall be flat aluminum alloy at least 0.05 inch (1.3 mm) (No. 18 gage) thick with rounded corners and shall withstand distortion in 70 mph (115 km/h) winds and shall be firmly attached to each signal face to withstand the above wind load and to permit the opening of any signal door independent from the other doors in the signal face. Width of backplates shall extend a minimum of 5 1/2 inches (140 mm) from the signal head on all 4 sides or as specified on the plans. Backplates shall be furnished with an oven baked dull black enamel finish on the front and back. Backplates shall also be furnished with a 3 inch (75 mm) yellow reflective strip around the perimeter conforming to ASTM D4956 Type X.

Subsection 1020.04, Poles for Traffic Signal Systems is amended as follows.

Heading (b), Steel Signal Support Pole is deleted and the following substituted.

(b) Steel Signal Support Pole:

(1) General: Poles and fittings shall be in accordance with the plans and shall be galvanized in accordance with ASTM A 123 and A 153. Poles shall be suitable for a minimum horizontal load of 4,000 pounds (1800 kg) applied 1 foot (300 mm) below the top of pole.

(2) Pole Shaft: The pole shaft shall have a minimum base diameter of 11 inches (280 mm) and a maximum base diameter of 11 3/4 inches (295 mm). The pole shaft shall be tapered to 7 1/2 inch (191 mm) minimum to 8 1/2 inch (216 mm) maximum diameter at the top.

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The pole shaft may have a round or octagonal cross section. A removable cap shall be used to cover the top of the pole shaft.

The pole shall be designed so that its maximum deflection is as shown in Table 1020-6.

Table 1020-6
Steel Pole Deflection

Pole Length, ft (m)	Maximum Deflection, in/100 lb (mm/50 kg)
26 (7.9)	0.25 (7.0)
28 (8.5)	0.30 (8.4)
30 (9.1)	0.38 (10.6)

The pole base shall have the manufacturer's name and pole height stenciled on it and shall be readable from the outside of the pole. The stencil shall be legible after galvanizing.

(3) Hand Holes and Bosses: A hand hole shall be provided approximately 18 inches (450 mm) above the base with approximate dimensions of 4 inches by 6 1/2 inches (100 mm by 165 mm) and cover shall be provided. The cover shall be restrained to the pole with a 15 inch (380 mm) No. 35 stainless steel chain fastened to the cover and to the inside of the hand hole so that the chain will be inside the pole after the cover is installed on the pole. There shall be no sharp edges on the cover, in the hand hole, or in the pole. The cover shall have the manufacturer's name and the pole height stenciled on it, readable from the outside of the pole. The stencil shall be legible after galvanizing. The hand hole strain bar shall be formed to provide a mechanical lock against the hand hole to prevent turning. No obstructions shall be in the hand hole with the cover removed. A grounding nut (1/2 inch (13 mm)-13NC) shall be welded to the inside of the shaft 90 degrees left and horizontal from the hand hole. A grounding lug shall be provided with each pole.

All poles shall have one 1-inch (25 mm) and one 3-inch (75 mm) boss centered on a horizontal line 18 inches (450 mm) from the base and one 1-inch (25 mm) and two 3-inch bosses 18 inches (450 mm) from the top. When facing the bosses, the 1-inch (25 mm) boss shall be 35 degrees (± 3 degrees) to the right of the 3-inch (75 mm) boss. The 3-inch (75 mm) boss shall be located 180 degrees from the hand hole. The bosses at the top of the pole shall be in line with the bosses at the bottom. The poles shall be shipped with all bosses plugged using galvanized steel conduit plugs installed to full thread depth. On octagonal poles the 3-inch boss shall be centered on one face that is parallel to one edge of the base plate.

NS GPS (04/09):

DESCRIPTION. This item shall consist of furnishing and installing a NEMA compliant GPS KIT time device on a traffic signal controller cabinet and connecting the GPS to the controller in accordance with the plans, the 2006 Louisiana Standard Specifications for Roads and Bridges and the manufacturer's installation requirements. This specification also sets forth the minimum requirements for a solid-state traffic control GPS KIT time device to work in accordance with controllers meeting requirements of the Louisiana Department of Transportation and Development Traffic Control Standard Number 18A latest revision.

MATERIALS. Vacant.

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EQUIPMENT.

The GPS KIT shall contain all needed equipment to connect and mount the GPS to a NEMA compliant controller and cabinet. Once installed the GPS shall supply the controller with the time and date. All communication between the GPS and Controller shall meet all NEMA protocols. The status of the GPS unit shall be given through the controller screen.

Warranty:

The equipment shall be supplied with a minimum of a one year manufacturer warranty. All warranty periods shall begin at the date of acceptance by the Department.

CONSTRUCTION REQUIREMENTS.

The GPS shall communicate directly to the local controller, master controller and the system software described in the Louisiana Department of Transportation and Development Traffic Control Standard Number 18A latest revision without the need of any external devices other than the GPS device. The GPS shall be installed according to the manufacturer's recommendations. The seal between cabinet and GPS shall be waterproof.

MEASUREMENT.

This item will be measured per each GPS installed, which includes all labor, materials, tools, equipment, and incidentals necessary to complete the work.

PAYMENT. Payment for the GPS will be made at the contract unit price per each.

Payment will be made under:

<u>Item No.</u>	<u>Pay Item</u>	<u>Pay Unit</u>
NS-736-00001	GPS	Each

CONTRACT TIME (03/05): The entire contract shall be completed in all details and ready for final acceptance in accordance with Subsection 105.17(b) within **sixty (60) working** days.

Prior to assessment of contract time, the contractor will be allowed 30 calendar days from the date stipulated in the Notice to Proceed to commence with portions of the contract work including but not limited to assembly periods, preparatory work for materials fabrications such as test piles, or other activities which hinder progress in the beginning stages of construction. Prior to issuance of the Notice to Proceed, the Department will consider extending the assembly period upon written request from the contractor justifying the need for additional time.

The contractor shall be responsible for maintenance of traffic from the beginning of the assembly period. During the assembly period, the contractor will be allowed to do patching and other maintenance work necessary to maintain the roadway with no time charges when approved by the engineer.

If the contractor begins regular construction operations prior to expiration of the assembly period, the assessment of contract time will commence at the time construction operations are begun.

LOUISIANA
DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
SUPPLEMENTAL SPECIFICATIONS
(FOR 2006 STANDARD SPECIFICATIONS)

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**LOUISIANA
DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
SUPPLEMENTAL SPECIFICATIONS**

The 2006 Louisiana Standard Specifications for Roads and Bridges and supplemental specifications thereto are amended as follows.

PART I – GENERAL PROVISIONS

SECTION 101 – GENERAL INFORMATION, DEFINITIONS, AND TERMS:

Subsection 101.03 – Definitions (07/07), Pages 3 – 13.

Delete the definition for “Proposal/Bid Guaranty” and substitute the following.

Proposal / Bid Guaranty. The required security furnished with a bid. The only form of security acceptable is a Bid Bond.

SECTION 102 – BIDDING REQUIREMENTS:

Subsection 102.09 – Proposal / Bid Guaranty (07/07), Page 19.

Delete the contents of this subsection and substitute the following.

PROPOSAL/BID GUARANTY. Each bid shall be accompanied by a proposal/bid guaranty in an amount not less than five percent of the total bid amount when the bidder’s total bid amount as calculated by the Department in accordance with Subsection 103.01 is greater than \$50,000. No proposal/bid guaranty is required for projects when the bidder’s total bid amount as calculated by the Department is \$50,000 or less. The official total bid amount for projects that include alternates is the total of the bidder’s base bid and all alternates bid on and accepted by the Department. The proposal/bid guaranty submitted by the bidder shall be a bid bond made payable to the contracting agency as specified on the bid bond form provided in the construction proposal. No other form of security will be accepted.

The bid bond shall be on the "Bid Bond" form provided in the construction proposal, on a form that is materially the same in all respects to the "Bid Bond" form provided, or on an electronic form that has received Department approval prior to submission. The bid bond shall be filled in completely, shall be signed by an authorized officer, owner or partner of the bidding entity, or each entity representing a joint venture; shall be signed by the surety's agent or attorney-in-fact; and shall be accompanied by a notarized document granting general power of attorney to the surety's signer. The bid bond shall not contain any provisions that limit the face amount of the bond.

The bid bond will be written by a surety or insurance company that is in good standing and currently licensed to write surety bonds in the State of Louisiana by the Louisiana Department of Insurance and also conform to the requirements of LSA-R.S. 48:253.

All signatures required on the bid bond may be original, mechanical reproductions, facsimiles or electronic. Electronic bonds issued in conjunction with electronic bids must have written Departmental approval prior to use. The Department will make a listing of approved electronic sureties providers on the Bidx.com site.

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SECTION 107 – LEGAL RELATIONS AND RESPONSIBILITY TO PUBLIC:

Subsection 107.05 – Federal Aid Participation (04/08), Pages 57 and 58.

Delete the second paragraph.

SECTION 108 – PROSECUTION AND PROGRESS:

Subsection 108.04 – Prosecution of Work (03/05) Pages 74 and 75.

Add the following sentence to the third paragraph of Heading (b):

Should the surety or the Department take over prosecution of the work, the contractor shall remain disqualified for a period of one year from the completion of the project, unless debarment proceedings are instituted.

When the Department of Transportation and Development is not the contracting agency on the project, the second paragraph under Heading (c) is deleted.

PART II – EARTHWORK

SECTION 202 – REMOVING OR RELOCATING STRUCTURES AND OBSTRUCTIONS:

Subsection 202.06 – Plugging or Relocating Existing Water Wells (03/04), Page 105.

Delete the first sentence and substitute the following:

All abandoned wells shall be plugged and sealed at the locations shown on the plans, or as directed by the engineer, in accordance with the “Water Well Rules, Regulations, and Standards, State of Louisiana.” This document is available at the Department of Transportation and Development, Water Resources Section, P. O. Box 94245, Baton Rouge, Louisiana 70804-9245. The Water Resource Section’s telephone number is (225) 274-4172.

PART III – BASE COURSES

SECTION 302 – CLASS II BASE COURSE:

Subsection 302.01 – Description (12/08), Page 150.

Add the following to the third paragraph:

(6) Blended Calcium Sulfate

Subsection 302.02 – Materials (12/08), Pages 150 and 151.

Add the following to the first paragraph:

Blended Calcium Sulfate

1003.01 & 1003.03 (e)

Subsection 302.04 – General Construction Requirements (12/08), Page 152.

Add the following:

Blended calcium sulfate will be allowed in areas of new alignment, fill areas, and cut areas less than one foot.

In cut areas greater than one foot (300 mm), an additional one foot (300 mm) of undercut will be required prior to placement of BCS. The additional undercut area shall be replaced with non-plastic sand embankment and encapsulated with a Class D geotextile fabric. The additional

non-plastic material, geotextile fabric, and undercut shall be at no additional cost to the Department.

Blended calcium sulfate will not be allowed in areas needed to facilitate traffic control or when a soil cement base course is specified in the plans. Blended calcium sulfate shall not be placed within 10 feet (3.0 m) of metal drainage structures. The contractor will be allowed to substitute any untreated Class II base course material listed in Subsection 302.01. Flowable fill under Section 710, or other approved backfill material in Section 701 shall be used to backfill the drainage structure.

Subsection 302.05 – Mixing (08/06) (12/08), Pages 152 and 153.

Delete the first sentence of Subheading (b)(1), In-Place Mixing, and substitute the following.

In-place mixing shall conform to Heading (a)(1) except that the percentage of Type I portland cement required will be 6 percent by volume.

Add Heading (d) as follows:

(d) Blended Calcium Sulfate: Calcium sulfate shall be blended with an approved aggregate or lime prior to placement. The blended calcium sulfate material shall be uniformly mixed and sampled from dedicated stockpiles. Gradation sampling in accordance with Subsection 1003.03 shall be taken from the dedicated stockpiles at the point of material origin.

Subsection 302.06 – Transporting and Placing on Subgrade (12/08), Page 154.

Add the following:

Water shall be added or other suitable means taken to prevent dust during the transporting and placing of dry blended calcium sulfate.

Subsection 302.07 - Compacting and Finishing (12/08), Pages 154 and 155.

Add Heading (e) as follows:

(e) Blended Calcium Sulfate: Blended calcium sulfate shall be placed and spread on the subgrade and compacted to produce layers not exceeding 12 inches (300 mm) compacted thickness. During placement the material shall be thoroughly wetted by application of water to maintain 2 to 4 percent above optimum moisture. After application of water, allow the moisture to reach equilibrium in the base before applying rolling techniques. Rolling of BCS is required to the edge of the embankment or subgrade. Each layer shall be compacted to at least 95 percent of maximum dry density or compacted by an approved established rolling pattern determined by the project engineer before the next layer is placed. Optimum moisture and maximum density shall be determined in accordance with DOTD TR 418 Method G modified to include a maximum drying temperature of 140°F (60°C).

Add Heading (f) as follows:

(f) Proof Rolling: Proof rolling shall be done by a load of 25 tons (25 Mg) in a 12 to 14 cubic yard (9 to 10.5 cubic meters) tandem dump truck with ten wheels or approved loaded truck

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determined by the project engineer. Proof rolling shall be a minimum of 5 passes in each direction at the same locations and at a maximum vehicle speed of 3 mph (4.8 km/h).

All BCS base will be tested by proof rolling prior to placement of surfacing material, including asphalt binder. Any irregularities or soft spots shall be corrected prior to placement of the surfacing material. Any rain event on the project site between the proof rolling and placement of the surfacing will require an additional proof rolling as noted above.

Subsection 302.09 – Protection and Curing (12/08), Page 155.

Add Heading (c) as follows:

(c) Blended Calcium Sulfate: Protection and curing of blended calcium sulfate shall be in accordance with Subsection 302.09(b).

Subsection 302.12 – Acceptance Requirements (12/08), Pages 156 – 161.

Add the following to Heading (a):

The acceptance requirements for blended calcium sulfate base course shall be the same as stone base course with the following modifications. Upon completion of compaction operations, the density will be determined in accordance with DOTD TR 401 except that all moisture content determinations for density calculations shall be conducted by oven drying the material for 24 hours at 140°F (60°C). A forced draft type oven capable of maintaining the temperature shall be provided by the contractor for field moisture content determination for density control.

SECTION 305 – SUBGRADE LAYER:

Subsection 305.06 – Payment (01/08), Page 184.

Delete this subsection and substitute the following.

305.06 Payment. Payment for subgrade layer will be made at the contract unit price which includes lime, lime treatment, cement, cement treatment, water, stone, recycled portland cement concrete, crushed slag, blended calcium sulfate, asphaltic concrete, and asphalt curing membrane or prime coat, subject to the payment adjustment provisions of Section 1002 for specification deviations of asphalt materials and Subsection 303.11(a) for density deficiencies of cement treated materials. Adjustments in pay for increase or decrease in the percent cement ordered by the engineer will be in accordance with Subsection 303.13. Adjustments in pay for increase or decrease in the percent lime ordered by the engineer will be based on the price of lime shown on paid invoices (total of all charges). The Materials and Testing Section will provide the payment adjustment percentage for properties of asphalt materials.

Payment for geotextile fabric will be included in the contract unit price for subgrade layer.

Payment will be made under:

Item No.	Pay Item	Pay Unit
305-01	Subgrade Layer _____ in (mm) Thick	Square Yard (Sq m)

SECTION 307 – PERMEABLE BASES:

Subsection 307.02 – Materials (09/07), Pages 187 and 188.

Delete Heading (b), Asphalt and substitute the following.

(b) Asphalt: The asphalt for asphalt treated permeable base shall be an approved polymer modified asphalt cement, PG 76-22m, or PG 82-22rm complying with Section 1002. The percentage of asphalt cement shall be 2.0 percent to 4.0 percent by weight (mass) of the total mixture. Asphalt cement content and mixing process shall be such that all aggregates are visibly coated. The mixture shall retain 90 percent coating when tested in accordance with DOTD TR 317.

A job mix formula shall be submitted and approved in accordance with Section 502.

SECTION 308 – IN-PLACE CEMENT TREATED BASE COURSE:

All Subsections within Section 308 – (07/07), Pages 191 – 198.

Whenever the reference to “DOTD TR-432, Method D” is used, it shall mean “DOTD TR-432”.

PART V – ASPHALTIC PAVEMENTS

SECTION 502 – SUPERPAVE ASPHALTIC CONCRETE MIXTURES:

Subsection 502.02 – Materials (08/06) (11/07), Pages 210 – 213.

Delete Table 502-2, Superpave Asphalt Cement Usage under Subheading (a) and substitute the following.

Table 502-2
Superpave Asphalt Cement Usage

Current Traffic Load Level	Mixture Type	Grade of Asphalt Cement
Level 1	Wearing Course	PG 70-22m
	Binder Course	PG 70-22m
	Base Course	PG 64-22
Level 2	Wearing Course	PG 76-22m
	Binder Course	PG 76-22m
Level A	Incidental Paving	PG 70-22m

Note: A PG 82-22 rm, Waste Tire Rubber Modified Asphalt, may be substituted for any other grade of asphalt cement.

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Delete Table 502-3, Aggregate Friction Rating under Subheading (c)(1) and substitute the following.

Table 502-3
Aggregate Friction Rating

Friction Rating	Allowable Usage
I	All mixtures
II	All mixtures
III	All mixtures, except travel lane wearing courses with plan ADT greater than 7000 ¹
IV	All mixtures, except travel lane wearing courses ²

¹ When plan current average daily traffic (ADT) is greater than 7000, blending of Friction Rating III aggregates and Friction Rating I and/or II aggregates will be allowed for travel lane wearing courses at the following percentages. At least 30 percent by weight (mass) of the total aggregates shall have a Friction Rating of I, or at least 50 percent by weight (mass) of the total aggregate shall have a Friction Rating of II. The frictional aggregates used to obtain the required percentages shall not have more than 10 percent passing the No. 8 (2.36 mm) sieve.

² When the average daily traffic (ADT) is less than 2500, blending of Friction Rating IV aggregates with Friction Rating I and/or II aggregates will be allowed for travel lane wearing courses at the following percentages. At least 50 percent by weight (mass) of the total aggregate in the mixture shall have a Friction Rating of I or II. The frictional aggregates used to obtain the required percentages shall not have more than 10 percent passing the No. 8 (2.36 mm) sieve.

Subsection 502.14 – Lot Sizes (11/07), Pages 232 and 233.

Delete the first sentence of the first paragraph and substitute the following.

A lot is a segment of continuous production of asphaltic concrete mixture from the same job mix formula produced for the Department at a specific plant, delivered to a specific DOTD project.

SECTION 508 – STONE MATRIX ASPHALT:

Subsection 508.01 – Description (09/07), Page 274.

Delete this subsection and substitute the following.

508.01 DESCRIPTION. This work consists of furnishing and constructing Stone Matrix Asphalt (SMA) which is a plant mixed asphalt concrete wearing course for high traffic applications. This mixture is a rut resistant hot mix design with stone on stone contact. The mixture shall be composed of a PG 76-22m, or PG 82-22rm asphalt cement and a gap graded coarse aggregate structure. Mineral filler and/or fibers shall be used to control draindown. This work shall be in accordance with these specifications, plan details, and as directed. All requirements of Section 502 apply to Stone Matrix Asphalt, except as modified herein. All plant and paving equipment and processes must meet the requirements of Section 503.

Mixture used for shoulder may be Stone Matrix Asphalt or any mixture type shown in Table 502-5.

Subsection 508.02 – Materials (09/07), Page 274.

Delete the contents of Subheading (a), Asphalt Cement and substitute the following.

(a) Asphalt Cement: Asphalt cement shall be PG 76-22m, or PG 82-22rm as listed on QPL 41 and complying with Section 1002.

PART VI – RIGID PAVEMENT

SECTION 602 – PORTLAND CEMENT CONCRETE PAVEMENT

REHABILITATION:

Subsection 602.17 – Payment (09/07), Pages 341 – 344.

Delete the last paragraph of Subheadings (d), Full Depth Corner Patching of Jointed Concrete Pavement, (e) Full Depth Patching of Jointed Concrete Pavement, and (g) Patching Continuously Reinforced Concrete Pavement, and substitute the following.

Payment for deteriorated base course removed as directed by the engineer and replaced with concrete will be made as follows: The value per inch (mm) thickness will be determined by dividing the contract unit price per square yard (sq m) by the plan thickness. Thickness of patches will be measured from the surface that exists at the time of patching. Payment for the additional thickness will be made at 50 percent of the value per inch (mm) thus determined.

PART VII – INCIDENTAL CONSTRUCTION

SECTION 701 – CULVERTS AND STORM DRAINS:

All Subsections within Section 701 (08/07), Pages 347 – 358.

Delete Section 701, Culverts and Storm Drains and substitute the following.

SECTION 701 CULVERTS AND STORM DRAINS

701.01 DESCRIPTION. This work consists of furnishing, installing, and cleaning pipe, pipe arch, storm drains and sewers, also referred to as culverts or conduit, in accordance with these specifications and in conformity with lines and grades shown on the plans or established.

701.02 MATERIALS. Materials shall comply with the following sections and subsections:

Usable Soil	203.06(a)
Selected Soil	203.06(b)
Plastic Soil Blanket	203.10
Mortar	702.02
Flowable Fill	710
Portland Cement Concrete	901
Reclaimed Asphaltic Pavement (RAP)	1003.01 & 1003.04(d)
Stone	1003.03(b)
Recycled Portland Cement Concrete	1003.03(c)

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Granular Material	1003.07
Bedding Material	1003.08
Concrete Sewer Pipe	1006.02
Reinforced Concrete Pipe	1006.03
Reinforced Concrete Pipe Arch	1006.04
Gasket Materials	1006.06
Plastic Pipe	1006.07
Split Plastic Coupling Bands	1006.07(d)(4)
Plastic Yard Drain Pipe	1006.09
Bituminous Coated Corrugated Steel Pipe and Pipe Arch	1007.02
Structural Plate for Pipe, Pipe Arch and Arch	1007.04
Corrugated Aluminum Pipe and Pipe Arch	1007.05
Coupling Bands	1007.09
Reinforcing Steel	1009
Geotextile Fabric	1019

(a) Side Drain Pipe or Side Drain Pipe Arch: When the item for Side Drain Pipe or Side Drain Pipe Arch is included in the contract, the contractor has the option of furnishing reinforced concrete pipe or reinforced concrete pipe arch, corrugated metal pipe or corrugated metal pipe arch, or plastic pipe, as allowed by EDSM II.2.1.1 or unless otherwise specified.

(b) Cross Drain Pipe or Cross Drain Pipe Arch: When the item for Cross Drain Pipe or Cross Drain Pipe Arch is included in the contract, the contractor has the option of furnishing reinforced concrete pipe or reinforced concrete pipe arch, corrugated metal pipe or corrugated metal pipe arch, or plastic pipe, as allowed by EDSM II.2.1.1 or unless otherwise specified.

(c) Storm Drain Pipe or Storm Drain Pipe Arch: When the item for Storm Drain Pipe or Storm Drain Pipe Arch is included in the contract, the contractor has the option of furnishing reinforced concrete pipe or reinforced concrete pipe arch, or plastic pipe, as allowed by EDSM II.2.1.1 or unless otherwise specified.

(d) Yard Drain Pipe: When the item for Yard Drain Pipe is included in the contract, the contractor has the option of furnishing concrete sewer pipe, plastic yard drain pipe or plastic pipe in accordance with Section 1006 unless otherwise specified.

(e) Material Type Abbreviations:

(1) Reinforced Concrete Pipe:

RCP	Reinforced Concrete Pipe
RCPA	Reinforced Concrete Pipe Arch

(2) Corrugated Metal Pipe:

CAP	Corrugated Aluminum Pipe
CAPA	Corrugated Aluminum Pipe Arch
CMP	Corrugated Metal Pipe
CMPA	Corrugated Metal Pipe Arch
CSP	Corrugated Steel Pipe
CSPA	Corrugated Steel Pipe Arch

BCCSP	Bituminous Coated Corrugated Steel Pipe
BCCSPA	Bituminous Coated Corrugated Steel Pipe Arch
(3) Plastic Pipe:	
PP	Plastic Pipe
PVCP	Polyvinyl Chloride Pipe
RPVCP	Ribbed Polyvinyl Chloride Pipe
CPEPDW	Corrugated Polyethylene Pipe Double Wall

(f) Joint Type Abbreviations:

T1	Type 1 Joint
T2	Type 2 Joint
T3	Type 3 Joint

(g) Quality Assurance for Pipe: Manufacturing plants will be periodically inspected for compliance with specified manufacturing methods, and material samples will be randomly obtained for laboratory testing for verification of manufacturing lots. Materials approved at the manufacturing plant will be subject to visual acceptance inspections at the jobsite or point of delivery.

701.03 EXCAVATION. For all pipe, when the sides of the trench are stable as evidenced by the sides of the trench being able to maintain a vertical cut face, the minimum trench width at the bottom of the excavation will be 18 inches (460mm) on either side of the outside diameter of the pipe. If the sides of the trench are unstable, the width of the trench at the bottom of the excavation, for plastic or metal pipe, shall be a minimum width of at least 18 inches (460mm) or one pipe diameter on each side of the outside diameter of the pipe, which ever is greater. Surplus material or excavated material that does not conform to the requirements of Subsection 203.06(a) shall be satisfactorily disposed of in accordance with Subsection 202.02. Moisture controls including backfill materials selection and dewatering using sumps, wells, well points or other approved processes may be necessary to control excess moisture during excavation, installation of bedding, over-excavated trench backfilling, pipe placement and pipe backfill.

(a) Over-excavation: When unsuitable soils as defined in Subsection 203.04 or a stable, non-yielding foundation cannot be obtained at the established pipe grade, or at the grade established for placement of the bedding, unstable or unsuitable soils below this grade shall be removed and replaced with granular material meeting the requirements of Subsection 1003.07, bedding materials meeting the requirements of Subsection 1003.08 or Type A backfill. All granular, backfill materials placed below the established pipe or bedding grade shall be placed in lifts not exceeding 8 inches (200 mm) thick and sufficiently compacted by hand or a dynamic mechanical hand compaction device over the surface of each lift to form a stable, non-yielding foundation at the surface of the established bedding or pipe grade.

When rock is encountered, it shall be removed below grade and replaced with material complying with Subsection 1003.07, bedding materials meeting the requirements of Subsection 1003.08 or Type A backfill. The compacted earth cushion shall have a thickness under the pipe of at least 1/2 inch per foot (40 mm/m) of fill height over the top of the pipe with a minimum thickness of 8 inches (200 mm). All granular, backfill materials placed below the established pipe or bedding grade shall be placed in lifts not exceeding 8 inches (200 mm) thick and

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sufficiently compacted by hand or a dynamic mechanical hand operated compaction device over the surface of each lift to form a stable, non-yielding foundation at the surface of the established bedding or pipe grade.

Materials used to backfill in an over-excavated portion of a trench do not require encasement in a Geotextile Fabric.

Density of approved materials placed in over-excavated trenches will not be measured or determined.

701.04 FORMING PIPE BED. Bedding material, when specified, shall be constructed in accordance with Section 726. Materials allowed for bedding shall be as specified in Subsection 1003.08 or may be Type A backfill materials. When bedding materials are specified, additional excavation shall be performed below established pipe grade and the bedding material placed in lifts not exceeding 8 inches (200 mm) thick and lightly compacted by hand or a dynamic hand compaction device over the surface of each lift.

When the bottom of the pipe is not laid in a trench but is constructed above natural soils, a uniform bed shall be constructed as specified for the bottom of a trench.

Density of approved bedding materials will not be measured or determined.

701.05 LAYING PIPE. Pipe laying shall begin at the downstream end of the line. The pipe shall be in contact with the foundation throughout its length. Bell or groove ends of pipe and outside circumferential laps of riveted metal pipe shall be placed facing upstream. Riveted seam metal pipe shall be placed with longitudinal laps at sides. Pipes in each continuous line shall have the same wall thickness. Metal pipes provided with lifting lugs shall be handled only by these lugs.

After pipe has been laid and before backfill is placed, the engineer will inspect the pipe for alignment, grade, integrity of joints, and coating damage.

701.06 JOINING PIPE.

(a) Joint Usage:

(1) Type 1 (T1) joints shall be used for side drains under drives and similar installations.

(2) Type 2 (T2) joints shall be used for cross drains under roadways, including turnouts.

(3) Type 3 (T3) joints shall be used for closed storm drain systems, flumes and siphons.

(b) Concrete Pipe: Concrete pipe may be either bell and spigot, or tongue and groove. The method of joining pipe sections shall be such that ends are fully entered and inner surfaces are flush and even.

An approved mechanical pipe puller shall be used for joining pipes over 36 inches (900 mm) in diameter. For pipe 36 inches (900 mm) or less in diameter, any approved method for joining pipe may be used which does not damage the pipe.

Joints shall comply with Subsection 1006.05, and shall be sealed with gasket material installed in accordance with the manufacturer's recommendations.

(c) Metal Pipe: Metal pipe shall be firmly joined by coupling bands. Bands shall be centered over the joint.

For Type 1 joints, approved gasket material shall be placed in one corrugation recess on each side of the joint at the coupling band and on each band connection in such manner to prevent leakage.

When Type 2 or 3 joints are specified, joining of metal pipe sections shall conform to the following provisions:

(1) General: Band joints shall be sealed with gasket material. Gasket material shall be placed in accordance with the plan details.

(2) Circular Section: Connecting bands shall be of an approved design and shall be installed in accordance with plan details.

(3) Arch Section: Connecting bands shall be a minimum of 12 inches (300 mm) wide for pipe arch less than 36 inches (900 mm) round equivalent diameter, and a minimum of 21 inches (525 mm) wide for 36 inches (900 mm) round equivalent diameter pipe arch and greater. Bands shall be connected at the ends by approved angle or strap connections. Connecting bands used for 36 inches (900 mm) round equivalent diameter pipe arch and above shall be 2-piece bands.

(d) Plastic Pipe: Joints for plastic pipe shall be either bell and spigot or split coupling bands.

(1) Bell and Spigot Type Joint System: The method of joining pipe sections shall be such that ends are fully entered and inner surfaces are flush and even.

Any approved method for joining pipe may be used which does not damage the pipe.

Joints shall be approved and shall be sealed with a gasket system utilizing gasket material complying with Subsection 1006.06(a).

(2) Split Coupling Type Joint System: Split coupling bands shall comply with all dimensional and material requirements of Subsection 1006.07. The bands shall be centered over the joint. The split coupling band shall be secured to the pipe with a minimum of five stainless steel or other approved corrosion resistant bands.

Joints shall be approved and shall be sealed with gasket material. Gasket material shall be placed in the first two corrugation recesses on each side of the pipe connections. Gasket material shall also be placed on each band connection to prevent leakage. When flexible plastic gasket material is used it shall be a minimum of 1/2 inch (13 mm) in size. The bands shall be tightened to create overlap of the band and shall adequately compress the gasket material.

(e) Connections: Approved connections shall be used when joining new pipes to existing pipes. When concrete collars are required in order to extend the ends of existing pipes that have been damaged or to join different types or sizes of pipes, the concrete collars shall be constructed in accordance with plan details, the applicable requirements of Section 901, and as directed.

(f) Geotextile Fabric, Pipe Joints: For concrete, metal and plastic pipes, Types 2 and 3 joints shall be wrapped with geotextile fabric for a minimum of 12 inches (300 mm) on each side of joint for pipe 36 inches (900 mm) or less in diameter and a minimum of 18 inches (450 mm) on each side of the joint for pipe greater than 36 inches (900 mm) in diameter. Ends of the fabric shall be lapped at least 10 inches (250 mm). The edges and ends of fabric shall be suitably secured for the entire circumference of the pipe.

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701.07 RELAYING PIPE. If specified or directed, existing pipes shall be removed and suitable sections relaid as specified for new pipes.

701.08 BACKFILLING.

(a) General: Prior to backfilling, pipes found to be damaged or out of alignment or grade shall be removed and reinstalled, or replaced.

Type A backfill material shall be stone, recycled portland cement concrete, flowable fill, or RAP.

Type B backfill materials are selected soils. Where Type B backfill materials are called for, Type A backfill materials may be substituted.

When corrugated metal pipe is used, the backfill material shall be tested and shall have a resistivity greater than 1500 ohm-cm and a pH greater than 5 when tested in accordance with DOTD TR 429 and DOTD TR 430 respectively.

When Type A backfill material is used, geotextile fabric surrounding this backfill shall be placed in accordance with Subsection 726.03 between the aggregate backfill material and all other natural or placed soils in the trench or embankment. Care shall be taken to prevent damage to geotextile fabric during placement of backfill material. For concrete pipe, the fabric shall enclose not only the initial backfill but shall be wrapped over the top of the pipe with at least 12 inches (300 mm) of overlap.

When a trench box or trench sheeting is used in unstable soils and/or for worker safety, and when moved during backfilling operations, filling and additional compaction of the disturbed zone of backfill must take place immediately and in a manner acceptable to the engineer.

Initial backfill is a structural backfill encasing the pipe from the bottom of the pipe to the springline for concrete pipe and to a point one foot (0.3 m) above the top of the pipe for both metal and plastic pipe. Final backfill is not a structural backfill and shall extend from the top of the initial backfill to the top of the natural ground or subgrade in cut areas or to the top of existing ground in fill areas. Any fill required above the final backfill is considered and treated as embankment.

(b) Backfill Applications: For projects using A+B+C bidding method where rigid and flexible pavement alternates are considered, backfill application (2) below, "Cross Drains Under Flexible Pavements", shall apply for either rigid or flexible pavements.

(1) Under Concrete Pavements: Type B backfill may be used as initial and final backfill for all pipes, culverts or drains under concrete pavements. Placement and compaction shall be as specified in Heading (d) below.

(2) Cross Drains Under Flexible Pavements: All reaches, exclusive of those portions of the pipe which are under shoulders, of cross drains and all other culverts, pipes or drains that cross the centerlines of the new roadway or centerlines of existing roadways, such as intersections and are under flexible pavements shall receive an initial backfill of Type A material. Type B backfill materials may be used as final backfill for all pipes. Placement and compaction shall be as specified in Heading (c) and (d) below. Where the subgrade is above existing ground, embankment material as specified for the remainder of the project shall be used from the top of the final backfill to the top of the established embankment grade.

(3) Other Drains Under Flexible Pavements: All reaches of all culverts, pipes or drains under flexible pavements that do not cross the centerlines of new roadway or centerlines of existing roadways, and exclusive of those portions of the pipe which are totally under shoulders, shall receive an initial and final backfill of Type B material. Placement and compaction shall be as specified in Heading (d) below. Where the subgrade is above existing ground, embankment material as specified for the remainder of the project shall be used from the top of the final backfill to the top of the established embankment grade.

(4) Other Areas: All culverts, pipes or drains in nonpaved areas or paved areas that serve as driveways or shoulders shall receive an initial and final backfill of Type B material. Placement and compaction shall be as specified in Heading (d) below.

(5) Pipes Subject to Construction Traffic; The embankment or pipe backfill shall be constructed to a minimum of 24 inches (600 mm) over the pipe before heavy construction equipment is allowed to cross the installation. Where practical, installations with less than 24 inches (600 mm) of cover over the top of the pipe shall be constructed after heavy hauling is completed over the pipe location. After completion of hauling operations, the contractor shall remove excess cover material. Pipe damaged by hauling and backfilling operations shall be removed and reinstalled, or replaced, at no direct pay.

(c) Placement and Compaction; Type A Backfill: For all pipes, culverts and conduits under paved and nonpaved areas, where Type A backfill material is used, the Type A backfill shall be thoroughly hand compacted under the pipe haunches and then dynamically compacted in layers not exceeding 8 inches (200 mm) compacted thickness. Compaction under the haunches of the pipe shall initially be by hand tamping or other acceptable means, until a level is reached that the dynamic tamping can commence. Each lift shall be compacted by applying at least eight passes of a hand operated, dynamic mechanical compaction device over the surface of each lift. With approval of the engineer, layer thickness may be increased to 12 inches (300 mm) with verification of satisfactory installation and performance. If flowable fill is used it shall be furnished, placed and consolidated in accordance with Section 710. The contractor shall control placement operations during initial backfill operations so as not to damage protective coatings on metal pipes. The contractor shall repair damaged coatings at no additional pay.

(d) Placement and Compaction; Type B Backfill: For all pipes, culverts and conduits, where Type B backfill is allowed, the Type B material shall be placed in layers not exceeding 8 inches (200 mm) compacted thickness. Compaction shall be with suitable mechanical equipment. With approval of the engineer, layer thickness may be increased to 12 inches (300 mm) with verification of satisfactory installation and performance.

(e) Placement and Compaction; Trenchless or Partial Trench Condition: All pipes, culverts, drains and conduits placed with any portion of the pipe above existing ground must also comply with Subsections (a),(b) (c) and (d) above for the portion of the pipe within a trench and that portion of the pipe not constructed in a trench. The width of initial and final backfill of that portion above existing ground and not within a trench will be constructed to such a width that the requirements for placement, compaction and density are met.

(f) Density Requirements: The in place density of Type A backfill materials and bedding materials, will not be measured or determined. Type A backfill, exclusive of RAP and flowable

fill, shall be placed at or near optimum moisture content determined in accordance with DOTD TR 415 or 418. RAP materials shall be placed and compacted in a slightly moist condition.

The maximum dry density of initial or final Type B backfill under all paved areas which are to be under traffic will be determined in accordance with DOTD TR 415 or TR 418 and in-place density determined in accordance with DOTD TR 401. Initial and final Type B backfill under all paved areas, under traffic, shall be placed at or near optimum moisture content determined in accordance with DOTD TR 415 or TR 418. Each layer shall be compacted by approved methods prior to the placement of a subsequent layer. The engineer will approve the compaction method based upon validation that such method, including moisture control, will achieve at least 95 percent of maximum dry density as determined in accordance with DOTD TR 401. With approval of the engineer, density testing may be waived on subsequent layers with backfill installation in accordance with approved compaction methods and continued satisfactory performance.

Initial and final backfill in unpaved areas or paved areas such as shoulders or driveways, shall be placed evenly and compacted along the length of the culvert, pipe or drain from the top of the initial backfill to the top of the subgrade. Layered backfill shall be compacted at least to the density of the adjoining existing soils or the compaction required of the laterally adjoining layers of soil immediately outside the trench for embankment elevations. Initial and final backfill shall be placed and compacted at or near optimum moisture content determined in accordance with DOTD TR 415 or TR 418.

701.09 INSPECTION OF PIPES. After completion of embankment and prior to roadway surfacing, the engineer shall inspect pipes for proper alignment and integrity of joints. Any misaligned pipe or defective joints shall be corrected by the contractor at no direct pay.

(a) Plastic Pipe: Installed plastic pipe shall be tested to ensure that vertical deflections do not exceed 5.0 percent. Maximum allowable deflections shall be governed by the mandrel requirements stated herein.

Deflection tests shall be performed no sooner than 30 calendar days after installation and compaction of backfill. The pipe shall be cleaned and inspected for offsets and obstructions prior to testing.

For pipe 36 inches (900 mm) and less in diameter, a mandrel shall be pulled through the pipe by hand to ensure that maximum allowable deflections have not been exceeded. The mandrel shall be approved by the engineer prior to use. Use of an unapproved mandrel or a mandrel altered or modified after approval will invalidate the test. If the mandrel fails to pass, the pipe is overdeflected.

Unless otherwise permitted, overdeflected pipe shall be uncovered and, if not damaged, reinstalled. Damaged pipe shall not be reinstalled, but shall be removed and replaced with new pipe. Any pipe subjected to any method or process other than removal, which attempts, even successfully, to reduce or cure any overdeflection, shall be removed and replaced with new pipe.

The mandrel shall be a rigid, nonadjustable, odd-numbered legged (minimum 9 legs) mandrel having a length not less than its nominal diameter or 24 inches (600 mm), whichever is less. The minimum diameter at any point shall be 5.0 percent less than the base inside diameter of the pipe being tested. The mandrel shall be fabricated of steel, aluminum or other approved

material fitted with pulling rings at each end. The nominal pipe size and outside diameter of the mandrel shall be stamped or engraved on some segment other than a runner. A suitable carrying case shall be furnished.

For pipe larger than 36 inches (900 mm) in diameter, deflection shall be determined by a method approved by the engineer. If a mandrel is selected, the minimum diameter, length, and other requirements shall conform to the above requirements.

Mandrel testing shall be conducted by the contractor in the presence of the engineer. Mandrel testing shall be at no direct pay.

(b) Metal Pipe: If the inside diameter of metal pipe or rise dimension of metal pipe arch deflects more than 5.0 percent from original dimensions, they shall be removed and reinstalled, unless they do not rebound or are damaged. Pipe or pipe arch which are damaged or do not rebound shall be removed and replaced at no direct pay. Measurement of deflection will be made by the engineer away from rerolled ends.

701.10 CLEANING PIPES.

(a) Existing Pipes: Pipes designated to be cleaned shall be cleaned of soil, debris and other materials to the invert of the pipe. Designated pipes shall be cleaned by approved methods that will not damage the pipes. Any damage caused by the contractor's operations shall be satisfactorily repaired at no direct pay.

Removed soil, debris and other materials shall be disposed of in accordance with Subsection 202.02 or as otherwise approved in writing.

(b) Contractor Installed Pipes: Prior to final acceptance, pipes shall be cleaned of all debris and soil to the invert of the pipe at no direct pay.

Removed soil, debris and other materials shall be disposed of in accordance with Subsection 202.02 or as otherwise approved in writing.

701.11 STUBBING AND PLUGGING PIPES. When it is required that pipes be plugged, such plugs shall be constructed of Class R concrete complying with Section 901. Thickness of plug and method of construction shall be as directed.

When new pipes are to be stubbed into new or existing pipes or other structures, the connection shall be made with approved mortar complying with Subsection 702.02.

701.12 MEASUREMENT. Pipe, both new and relaid, will be measured in linear feet (lin m) as follows unless stated otherwise.

(a) Pipe not confined by fixed structures will be measured by the number of joints at the nominal length of each joint.

(b) Pipe confined by fixed structures will be measured along the pipe between the termini of pipe in structure walls.

(c) Pipe confined by a fixed structure on one end and unconfined at the other end will be measured along the pipe from the terminus of pipe in the structure wall to the unconfined end of pipe.

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(d) Fabricating of pipe tees, elbows and other fittings will be measured per each fitting. The length of pipe in such fittings will be included in the pay length measurement of pipes of which they form a part.

(e) Excavation required for installation of pipes will not be measured for payment, except as otherwise specified in Subsection 203.14.

(f) Furnishing and placing backfill material below existing ground level for pipes will not be measured for payment. Backfill material needed to complete backfill above natural ground and around pipes that extend above natural ground will be measured and payment will be made under applicable earthwork items. When specified, flowable fill will be measured and paid for in accordance with Section 710.

(g) Plugging and stubbing of pipes will not be measured for payment.

(h) Cleaning existing pipes will be measured by the length of pipe cleaned and accepted.

(i) Concrete collars will be measured per each.

701.13 PAYMENT.

(a) Payment for pipe will be made at the contract unit price per linear foot (lin m) of the types and sizes specified.

When plastic pipe is specified on the plans or elected to be used by the contractor, payment will be made at the contract unit price per linear foot (lin m) of the types and sizes specified in accordance with the payment schedule of Table 701-1.

Table 701-1
Payment Schedule for Plastic Pipe

Percent Payment	Stage of Completeness
75	After placement and backfill has been completed
25	After the pipe has met vertical deflection requirements in accordance with Subsection 701.09(a)

(b) Payment for fabricating pipe tees, elbows and other fittings will be made at the contract unit price per each fitting.

(c) When unstable conditions are encountered, the additional excavation will not be measured for payment; however, the additional materials furnished and placed for the pipe foundation will be measured and paid for as follows:

(1) Granular Materials: Payment will be made under the embankment item. The net section volume of the materials will be multiplied by 3 to determine the pay volume. When the contract does not include a pay item for embankment, payment will be made in accordance with Subsection 104.02.

(2) Bedding Material: Measurement and payment will be made in accordance with Section 726. When the contract does not include a pay item for bedding material, payment will be made in accordance with Subsection 104.02.

(d) Payment for cleaning existing pipes will be made at the contract unit price per linear foot (lin m).

(e) Payment for concrete collars will be made at the contract unit price per each.

Payment will be made under:

Item No.	Pay Item	Pay Unit
701-01	Cross Drain Pipe (Size & Type)	Linear Foot (Lin m)
701-02	Cross Drain Pipe Arch (Size & Type)	Linear Foot (Lin m)
701-03	Storm Drain Pipe (Size & Type)	Linear Foot (Lin m)
701-04	Storm Drain Pipe Arch (Size & Type)	Linear Foot (Lin m)
701-05	Side Drain Pipe (Size)	Linear Foot (Lin m)
701-06	Side Drain Pipe Arch (Size)	Linear Foot (Lin m)
701-07	Yard Drain Pipe (Size)	Linear Foot (Lin m)
701-08	Relaying Pipe	Linear Foot (Lin m)
701-09	Fabricating Pipe Fittings	Each
701-10	Reinforced Concrete Pipe (Extension)	Linear Foot (Lin m)
701-11	Reinforced Concrete Pipe Arch (Extension)	Linear Foot (Lin m)
701-12	Corrugated Metal Pipe (Extension)	Linear Foot (Lin m)
701-13	Corrugated Metal Pipe Arch (Extension)	Linear Foot (Lin m)
701-14	Cleaning Existing Pipes	Linear Foot (Lin m)
701-15	Concrete Collar	Each
701-16	Plastic Pipe (Extension)	Linear Foot (Lin m)

SECTION 704 – GUARD RAIL:

Subsection 704.03 – General Construction Requirements (01/05), Pages 368 and 369.

Add the following to Heading (d), Guard Rail End Treatments.

All end treatments shall bear a label indicating the manufacturer and exact product name of the end treatment along with its assigned NCHRP 350 test level. This label shall resist weathering and shall be permanently affixed to the railing in such a way as to be readily visible.

SECTION 706 – CONCRETE WALKS, DRIVES AND INCIDENTAL PAVING:

All Subsections within Section 706 (04/08), Pages 375 – 377.

Delete Section 706, Concrete Walks, Drives and Incidental Paving and substitute the following.

SECTION 706
CONCRETE WALKS, DRIVES AND INCIDENTAL PAVING

706.01 DESCRIPTION. This work consists of furnishing and constructing portland cement concrete walks, handicapped curb ramps, drives and incidental paving slabs in accordance with

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these specifications and in conformity with lines, grades and dimensions shown on the plans or established.

706.02 MATERIALS. Materials shall comply with the following Section or Subsections.

Portland Cement Concrete (Class M)	901
Joint Filler	1005.01(c)
Reinforcing Steel	1009.01
Curing Materials	1011.01

706.03 CONSTRUCTION REQUIREMENTS.

(a) Excavation: Excavation shall be made to required depth and width. The top of the subgrade shall be shaped and compacted to a firm, even surface conforming to the section shown on the plans. Unsuitable material shall be removed and disposed of in accordance with Subsection 202.02 and replaced with approved material at no direct pay.

(b) Forms: Forms shall be of wood or metal and shall extend the full depth of concrete. Forms shall be straight, clean and of sufficient strength to resist the pressure of concrete. Bracing of forms shall be such that forms remain in horizontal and vertical alignment until their removal.

Concrete may be placed by slip-form methods. Slip-formed concrete shall be placed with an approved machine designed to spread, vibrate, consolidate and finish concrete in one pass of the machine in such manner that minimum hand finishing is necessary. Sliding forms shall be rigidly held together to prevent spreading of forms. After the passing of the side forms there shall be no noticeable slumping of concrete.

(c) Subgrade: The subgrade shall be thoroughly moistened immediately prior to placing concrete.

(d) Placing and Finishing: Concrete shall be placed on the subgrade, struck off to required thickness and tamped sufficiently to bring the mortar to the surface. The surface shall be finished with a wood float or steel trowel followed by brushing to a slightly rough finish. Joints and edges shall be rounded with an edging tool having a 1/4-inch (6 mm) radius.

(e) Joints:

(1) Expansion Joints: Expansion joints shall be filled with 1/2 inch (13 mm) thick preformed expansion joint filler. Expansion joints shall be installed at maximum 100-foot (30 m) intervals, and between intersecting paving and any fixed structure such as a building, bridge or curbing, and between intersecting paving and the handicapped curb ramps. Expansion joint material shall extend for the full width and depth of paving.

(2) Weakened Plane: Weakened planes shall be formed by a jointing tool or other acceptable means. Weakened planes shall extend into concrete for at least 1/4 of the depth and shall be approximately 1/8 inch (3 mm) wide.

a. Walks: Spacing of weakened planes for walks shall be equal to the width of walk.

b. Drives: A longitudinal weakened plane shall be formed along the centerline of drives more than 16 feet (5 m) wide, and transverse weakened planes shall be formed at not more than 16-foot (5 m) intervals.

c. Incidental Paving: Weakened planes for incidental paving shall be formed at intervals not exceeding 30 times the thickness of the concrete in length or width. Incidental paving poured adjacent to jointed concrete shall be jointed to match existing joints, with intermediate joints formed as necessary not to exceed the maximum joint spacing.

(3) Construction Joints: Construction joints shall be formed around manholes, utility poles, etc., extending into paving and 1/4 inch (6 mm) thick preformed expansion joint filler shall be installed in these joints.

(4) Tie-ins: Tie-ins of existing concrete shall be made by full depth sawing at no direct pay.

(f) Curing: Concrete shall be cured in accordance with Subsection 601.10.

(g) Detectable Warning Surface for Handicap Ramps and At-Grade Sidewalk Intersections: Sidewalks, when intersecting with roadways, shall be equipped with a detectable warning surface system consisting of raised truncated domes as a transition between the sidewalk and the street as required by the Americans with Disabilities Act, 28 CFR Part 36, ADA Standards for Accessible Design.

Detectable warnings (truncated domes) shall be installed on the ramp surface over the full width of the ramp throat for a distance of 24 inches (600 mm) in the direction of travel from the back of the curb. Detectable warnings (truncated domes) shall also be installed on at-grade sidewalks intersecting with roadways for a distance of 36 inches (900 mm) in the direction of travel from the end of the sidewalk. Truncated domes shall be laid out on a square grid in order to allow enough space for wheelchairs to roll between the domes.

Light reflectance of the truncated domes and the underlying surface must meet the 70 percent contrast requirement of ADAAG.

706.04 MEASUREMENT. Quantities of concrete walks, drives and incidental paving slabs for payment will be the design quantities as specified on the plans and adjustments thereto. Design quantities will be adjusted if the engineer makes changes to adjust to field conditions, if design errors are proven or if design changes are made. Design areas are based on the horizontal dimensions shown on the plans. Excavation, backfill, reinforcing steel and joint materials will not be measured for payment.

Handicapped curb ramps, including the detectable surface warning system, will be measured per each.

Detectable surface warning systems for at-grade sidewalk intersection will not be measured for payment.

706.05 PAYMENT. Payment for concrete walks, drives and incidental paving will be made on a lot basis at the contract unit price per square yard (sq m), adjusted in accordance with the following provisions. Payment for each lot will be made in accordance with Table 901-6. Size, sampling, and testing of each concrete lot shall be in accordance with the Materials Sampling Manual.

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Payment for handicapped curb ramps, including the detectable surface warning system, will be made by each and shall include, but not limited to, curb transitions, detectable warning system, gutter, landing and base.

Payment will be made under:

Item No.	Pay Item	Pay Unit
706-01	Concrete Walk (inch (mm) Thick)	Square Yard (Sq m)
706-02	Concrete Drive (inch (mm) Thick)	Square Yard (Sq m)
706-03	Incidental Concrete Paving (inch (mm) Thick)	Square Yard (Sq m)
706-04	Handicapped Curb Ramps	Each

SECTION 713 – TEMPORARY TRAFFIC CONTROL:

Subsection 713.06 – Pavement Markings (08/06), Pages 400 – 403.

Delete Table 713-1, Temporary Pavement Markings and substitute the following.

Table 713-1
Temporary Pavement Markings^{1,2}

		Two-lane Highways	Undivided Multilane Highways	Divided Multilane Highways
SHORT TERM	ADT<1500; or ADT>1500 and time<3 days	Lane lines 4-foot (1.2 m) tape on 40-foot (12 m) centers; with "Do Not Pass" and "Pass With Care" signs as required		
	ADT>1500; Time>3 days and<2 weeks	Lane lines 4-foot (1.2-m) tape on 40-foot (12-m) centers with no passing zone markings		
	All ADT's with time <2 weeks		Lane lines 4-foot (1.2m) tape on 40-foot (12 m) centers; double yellow centerline	Lane lines 4-foot (1.2 m) tape on 40-foot (12 m) centers
LONG TERM	All ADT's with time >2 weeks	Standard lane lines, no-passing zone markings, legends and symbols and when pavement width is 22 feet (6.7 m) or greater, edge lines	Standard lane lines, centerlines, edge lines, and legends and symbols	Standard lane lines, centerlines, edge lines, and legends and symbols.

¹No-passing zones shall be delineated as indicated whenever a project is open to traffic.

²On all Asphaltic Surface Treatments that are open to traffic and used as a final wearing course or as an interlayer, temporary pavement markings (tabs) on 20-foot (6 m) centers shall be used, in lieu of the 4-foot (1.2 m) tape, on 40-foot (12 m) centers.

SECTION 719 – LANDSCAPING:

Subsection 719.06 – Construction Methods (03/09), Pages 429 – 432.

Delete the first paragraph of Heading (a), Seasonal Operations and substitute the following.

Unless otherwise directed by the engineer in writing, the planting season is between November 1 and April 15.

SECTION 729 – TRAFFIC SIGNS AND DEVICES:

Subsection 729.02 – Materials (04/08), Pages 456 and 457.

Delete the contents of Heading (a), Sign and Marker Sheeting, and substitute the following.

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(a) Sign and Marker Sheeting: Sheeting material for sign panels, delineators, barricades and other markers shall comply with Section 1015. All permanent signs shall meet the requirements of ASTM D 4956, Type X.

Subsection 729.04, Fabrication of Sign Panels and Markers (04/08), Pages 458 – 460.

Delete the third paragraph of Heading (c), Sheeting Application and substitute the following.

ASTM D 4956 Type X reflective sheeting shall be applied with an orientation determined by the engineer to obtain the optimum entrance angle performance. Fabricated vertical splices in ASTM D 4956 Type X reflective sheeting will be allowed only when the horizontal dimension of the sign face or attached shield is in excess of the maximum manufactured width of the sheeting. Fabricated vertical splices in ASTM D 4956 Type X reflective sheeting will also be allowed when the specified orientation will create excessive sheeting waste.

SECTION 730 – ELECTRICAL SYSTEMS:

Subsection 730.04 – Drawings and Equipment Submittals (03/09), Pages 468 and 469.

Delete the third sentence of Heading (b), As-Built Drawings and substitute the following:

The drawings shall show the exact location of the underground wiring, light poles, junction boxes, under roadway crossings, service poles, controllers, disconnects, and conduit or cables.

Subsection 730.08 – Measurement (03/09), Pages 470 – 472.

Delete Heading (e), Jacked or Bored Casing and substitute the following:

(e) Jacked or Bored Casing: Jacked or bored casings will be measured by the linear foot (lin m) of casing furnished and installed, which will include the casing, fittings, and required excavation and backfill.

Add the following:

(t) Modular Breakaway Cable System: Modular breakaway electrical cable systems for low mast light poles shall be measured per each and shall include all materials, labor, equipment, and tools necessary to furnish and install a complete system in accordance with the plans and specifications.

(u) Disconnect: Disconnects shall be measured per each and shall include all materials, labor, equipment, and tools necessary to furnish and install this item in accordance with the plans and specifications.

(v) Duct Markers: Duct markers shall be measured per each and shall include all materials, labor, equipment, and tools necessary to furnish and install this item in accordance with the plans and specifications.

(w) Underground Marker Tape: Marker tape shall be measured per linear foot and shall include all materials, labor, equipment, tools necessary to furnish and install this item in accordance with the plans and specifications.

Subsection 730.09, Payment (03/09), Pages 472 and 473.

Add the following pay items.

<u>Item No.</u>	<u>Pay Item</u>	<u>Pay Unit</u>
730-19	Modular Breakaway Cable System	Each
730-20	Disconnect (Type)	Each
730-21	Duct Marker (Type)	Each
730-22	Underground Marker Tape (Size and Type)	Linear Foot (Lin m)

SECTION 732 – PLASTIC PAVEMENT MARKINGS:

All subsections within Section 732 (10/11), Pages 477 – 482.

Delete Section 732, Plastic Pavement Markings and substitute the following:

Section 732
Plastic Pavement Markings

732.01 DESCRIPTION. This work consists of furnishing and placing reflective pavement markings of hot applied thermoplastic or preformed (cold or hot applied) plastic at the locations shown on the plans or as directed. This work shall be in compliance with the MUTCD, plan details and these specifications. Plastic pavement markings include stripes, gore markings, lines, legends and symbols.

732.02 MATERIALS.

(a) Thermoplastic Markings: Thermoplastic marking material shall be a plastic compound reflectorized by internal and external application of glass beads, complying with Subsections 1015.10 and 1015.13. Black thermoplastic marking material shall be used according to the standard plans on all portland cement concrete pavement. This material shall not require glass beads. Width and color of markings shall be as specified.

Thermoplastic material shall be delivered in containers of sufficient strength to permit normal handling during shipment and transportation without loss of material. Approved heat-degradable containers that can be placed in heating kettles along with the plastic material will be permitted. Each container shall be clearly marked to indicate color of material, process batch number, name of manufacturer and date of manufacture.

The material, upon heating to application temperature, shall not give off fumes that are toxic to persons or property. The maximum elapsed time after application which normal traffic will leave no impression or imprint on the new strip shall be 60 seconds when the air and road surface temperature is approximately 68°F ± 5°F (20°C ± 3°C). The material shall provide a stripe that has a uniform thickness throughout its cross-section.

(b) Preformed Plastic Markings: Preformed plastic markings shall comply with Subsection 1015.11.

(c) Surface Primer: A single component surface primer or two component epoxy primer sealer shall be provided by the contractor for the appropriate application in accordance with Subsection 732.03(e). The primer shall form a continuous film that dries rapidly and adheres to

the pavement. The primer material shall not discolor or cause any noticeable change in the appearance of the pavement outside of the finished pavement marking. A sample of the primer shall be submitted with the recommended method of application to the engineer and to the manufacturer of the thermoplastic marking material. Written approval shall be obtained from the engineer and the manufacturer before applying the primer.

(d) Glass Beads: Glass beads used for drop-on application to molten plastic shall be shipped in moisture resistant sacks (containers). The sacks shall be strong enough to permit handling without damage. Sacks shall be sufficiently water-resistant so that beads will not become wet or caked in transit.

Glass beads for standard (flat) thermoplastic markings shall be in accordance with Subsection 1015.13.

732.03 CONSTRUCTION REQUIREMENTS FOR PLASTIC PAVEMENT MARKING MATERIAL.

(a) Equipment for Standard (Flat) Thermoplastic Marking Material:

The application equipment shall consist of an extrusion die or a ribbon gun that simultaneously deposits and shapes lines at a thickness of 90 mils (2.3 mm) or greater on the pavement surface. When restriping onto existing thermoplastic markings, only a ribbon gun shall be used. Finished markings shall be continuous and uniform in shape, and have clear and sharp dimensions. Applicators shall be capable of producing various widths of traffic markings. Applicators shall produce sharply defined lines and provide means for cleanly cutting off stripe ends and applying broken lines. The ribbon extrusion die or shaping die shall not be more than 2 inches (50 mm) above the roadway surface during application. A spray application will only be allowed when applying 40 mil (1.0 mm) thermoplastic.

The application equipment shall provide continuous mixing and agitation of material. Thermoplastic conveying equipment components located between the main material reservoir and discharge mechanism shall be free from material accumulation and clogging. Parts of application equipment in contact with the material shall be easily accessible for cleaning and maintaining. Mixing and conveying equipment shall maintain material at the application temperature.

Glass beads shall be applied to the molten surface of completed stripes by either a single drop or a double drop application depending on the thickness of the thermoplastic striping as shown in Table 1015-13. Glass beads for single drop applications and the first (large) bead drop for double drop applications shall be applied by a gravity bead dispenser attached to the striping machine in such a manner that beads are dispensed simultaneously with the thermoplastic material at a controlled rate of flow on installed lines. The second (small) bead drop shall be applied immediately after the first bead drop by a gravity bead dispenser attached to the striping machine.

Applicators and kettles shall be equipped and arranged to comply with requirements of the National Board of Fire Underwriters. Applicators shall be maneuverable to the extent that straight lines can be followed and normal curves can be made in a true arc. Applicator equipment shall consist of a motorized mobile unit capable of installing traffic stripes either left or right of the applying unit so that only one lane of traffic will be occupied during installation.

(b) Weather Limitations: Application of markings will not be permitted when there is excessive pavement moisture. The pavement shall be considered excessively moist when it is visibly wet or when a 1 square foot (0.1 sq m) piece of polyethylene film condenses moisture after being placed on the pavement surface for 15 minutes. The surface temperature and the ambient temperature must be 50°F (10°C) and rising to begin striping operations. Striping operations shall cease when either temperature reaches 50°F (10°C).

(c) Cleaning of Surfaces: Surfaces on which markings are to be applied shall be cleaned of materials that may reduce adhesion of the thermoplastic marking materials to the pavement. Cleaning shall be done by blast cleaning or grinding. Surfaces shall be kept clean until placement of markings.

(d) Removal of Existing Markings:

(1) 40 Mil (1.0mm): Existing thermoplastic markings that are not flaking or peeling will not require removal prior to placement of thermoplastic. Flaking or peeling material shall be removed by mechanical sweeper or wire brush to the satisfaction of the engineer prior to thermoplastic application.

(2) 90 Mil (2.3mm): Existing thermoplastic markings and painted markings, regardless of condition, shall be removed prior to placement of 90 mil (2.3 mm) thick or greater thermoplastic except on asphalt pavements, unless otherwise directed.

(3) Intersection Markings, Legends and Symbols: Existing markings shall be removed from the pavement surface so that 125 mils of new markings can be applied.

(4) Preformed Plastic Markings (Tape): Existing markings shall be removed from the pavement surface before applying the preformed plastic markings (tape).

Removal of markings shall be accomplished by methods that will not damage the pavement or bridge deck. After the markings are removed, the debris and residue shall be picked up and disposed of by the contractor so that the primer and thermoplastic can adhere to the pavement. At the end of each day's operations the engineer may direct that temporary pavement markings complying with Section 713 be used in areas where existing markings have been removed and new markings not placed. Temporary pavement markings shall be satisfactorily removed prior to resuming thermoplastic marking operations.

All markings made in error or not conforming to the traffic operation in use shall be removed by either an abrasion or burning process to the satisfaction of the engineer. Markings shall not be obliterated by painting with asphalt binder or other material.

(e) Application of Surface Primer: A single component surface primer will be required prior to placement of thermoplastic markings over oxidized asphalt, when striping over existing thermoplastic on portland cement concrete surfaces, or when 40 mil (1.0 mm) thick thermoplastic is allowed to be placed over existing markings on concrete surfaces, unless otherwise directed by the engineer. A two component epoxy primer sealer will be required prior to placement of thermoplastic materials on portland cement concrete surfaces, unless otherwise directed by the engineer.

(f) Application of Markings: Material shall be installed in specified widths from 4 inches to 8 inches (100 mm to 200 mm) for 40 mil (1.0 mm) applications and from 4 inches to 24 inches (100 mm to 600 mm) for 90 mil (2.3 mm) applications. Finished lines shall have well defined edges and be free of waviness. Measurements shall be taken as an average through any 36-inch

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(900 mm) section of line. Longitudinal lines shall be offset approximately 2 inches (50 mm) from longitudinal joints. A tolerance of +1/2 inch and -1/8 inch (+13 mm and -3 mm) from the specified width will be allowed, provided the variation is gradual. Segments shall square off at each end without mist or drip. Transverse variations from the control device up to 1 inch (25 mm) will be allowed provided the variation does not increase or decrease at the rate of more than 1/2 inch in 25 feet (15 mm in 10.0 m). Lines not meeting these tolerances shall be removed and replaced at no direct pay.

(1) Thermoplastic Markings: For extruded or ribbon gun applied markings, the thickness of material, not including drop-on beads, shall be not less than 90 mils (2.3 mm) for lane lines, edge lines, black contrast, and gore markings and not less than 125 mils (3.2 mm) for crosswalks, stop lines, and word and symbol markings.

For spray applications the thickness of material, not including drop-on beads, shall not be less than 40 mils (1.0 mm).

Thermoplastic material at 90 mil (2.3 mm) thickness or greater shall be applied by extrusion at 390°F to 450°F (200°C to 230°C), unless otherwise recommended by the manufacturer. Thermoplastic material at 40 mil (1.0 mm) thickness shall be applied by spray at 410°F to 450°F (210°C to 230°C). Immediately after application of the markings, glass beads for a single drop application shall be applied at a minimum rate of 141 pounds per mile (40 kg/km) for a 4-inch (100 mm) solid line stripe. Glass beads for a double drop application shall be applied at a minimum rate of 211 pounds per mile (60 kg/km) for each drop on a 4-inch (100 mm) solid line. Black thermoplastic pavement marking material shall not require glass beads. Material shall not scorch or discolor when kept at this temperature range for 4 hours.

(2) Preformed Plastic Markings: Plastic tape shall be applied with adequate pressure to ensure proper adhesion. Preformed heat-applied thermoplastic material shall be applied in accordance with the manufacturers' recommendation. Material not adhering properly shall be satisfactorily corrected at no direct pay.

(g) Field Testing of Roadway Markings: The contractor will field test the pavement markings in accordance with Subsections 1015.10 and 1015.11 and Table 732-1. Failure to meet these requirements will require the contractor to replace the portion of the material shown to be out of specifications as directed.

(h) Initial Requirements Corrective Work: Any line found to be defective shall be restriped as directed by the engineer. The corrective work shall also be subject to these requirements and as noted in Table 732-2, "Payment Adjustments for Initial Retroreflectivity." The contractor shall provide the materials and install the pavement marking at no direct pay.

(i) Subsequent (Warranty) Requirements Corrective Work: The Department will take subsequent readings not later than one year after installation. The retroreflective requirements for warranty readings are in accordance with Subsection 1015.10(c)(3), "Retroreflectivity". If a project fails to meet retroreflective requirements the contractor shall, at no cost to the Department, replace the materials and install the pavement markings. The Department will determine if the failure is due to poor workmanship or due to no fault of the contractor. Disputes will be resolved by the Chief Engineer.

(j) Guarantee: Work performed in accordance with this Section shall be guaranteed as specified in Subsection 104.05, "Guarantees".

732.04 MEASUREMENT.

(a) Plastic Pavement Striping: Plastic striping will be measured by the linear foot (lin m) or mile (km), as specified. When a bid item is not included for gore markings, the Department will measure the quantity by converting the actual length and width of line installed to an equivalent length of the normal width line on that section of roadway.

(1) Linear Foot (Lin m): Measurement will be made by the linear foot (lin m) of striping, exclusive of gaps.

(2) Mile (km): Measurement will be made by the mile (km) of single stripe. No deduction will be made for standard 30-foot (9 m) design gaps in broken-line striping; however, deductions will be made for the length of other gaps or omitted sections.

(b) Plastic Pavement Legends and Symbols: Plastic legends and symbols will be measured per each legend or symbol. Symbols shall include all letters, lines, bars or markings necessary to convey the message at each location.

(c) Removal of Existing Markings: Removal of existing pavement markings for undivided highways will be measured by the linear mile (km) of full roadway width including shoulders. For divided highways, the full roadway width including shoulders and ramps will be measured separately for each direction of travel. Removal of pavement markings will include removal of lane lines, edgelines, gore markings, legends, symbols, and raised pavement markers.

732.05 PAYMENT. Payment for the completed and accepted quantities of plastic pavement markings and removal of existing markings will be made at the contract unit prices, or in accordance with Table 732-2, "Payment Adjustments for Initial Retroreflectivity."

Payment will be made under:

<u>Item No.</u>	<u>Pay Item</u>	<u>Pay Unit</u>
732-01	Plastic Pavement Striping (inch (___mm) Width)	Linear Foot (Lin m)
732-02	Plastic Pavement Striping (Solid Line) (inch (___mm) Width)	Mile (km)
732-03	Plastic Pavement Striping (Broken Line) (inch (___mm) Width)	Mile (km)
732-04	Plastic Pavement Legends and Symbols (Type)	Each
732-05	Removal of Existing Markings	Mile (km)

Table 732-1
Field Testing of Plastic Pavement Markings

Length of Roadway	Minimum Required Readings
Less than 1 mile (1.6 km)	10 evenly spaced readings per line type/color ¹
1 mile (1.6 km) to 6 miles (9.6 km)	10 evenly spaced readings per line type/color for each 1 mile (1.6 km) section ¹
Greater than 6 miles (9.6 km)	5 evenly spaced readings per line type/color for each 1 mile (1.6 km) section ²
Legends and Symbols	Visual night time inspection only
8", 16" and 24" Lines	5 readings per line/color ²
¹ Average of 10 readings per set ² Average of 5 readings per set	
<p>Measurements</p> <ol style="list-style-type: none"> Each line type/color will be measured separately. Measurements will be taken on dry, clean roadways. Data will be collected in direction of traffic flow. On broken lines (skip striping), no more than two readings will be taken per stripe, with readings 20 inches (0.5 m) from ends of marking. The Department may take additional readings. Acceptance will be based on the average of each set of readings for each line type/color. Failure of the average reading for any segment to meet the specified minimum values will require replacement, corrective action or subject to payment adjustments specified in Table 732-2, "Payment Adjustment for Initial Retroreflectivity". Limits of replacement will be determined by the engineer. Line widths 8"; 16"; and 24" will be tested per each location or as directed by the engineer. Retroreflectivity shall match 40 mil (1.0 mm) requirements. Aggregate Surface Course projects will not be tested for retroreflectivity, but will be visual inspected at night for acceptance by the engineer. Multiple lane roadways will require testing of each lane line per mile. No reflectance readings are required for black thermoplastic pavement markings. 	

Table 732-2
Payment Adjustment for Initial Retroreflectivity

Contract Unit Price ¹ , %	White (mcd\lux\m ²)		Yellow (mcd\lux\m ²)	
	40 mil (1.0 mm)	90 mil (2.3 mm)	40 mil (1.0 mm)	90 mil (2.3 mm)
103 ²	350	450	225	300
100	250	375	175	250
90	230	360	165	230
80	220	340	155	220
50 or Restripe	200	325	150	200

¹The payment requirements are based on the project total average of all test segments for initial reading in accordance with Table 732-1.

²There cannot be any test segments meeting less than 100 percent pay within the project limits to qualify for the bonus payment.

All subsections within Section 737 (09/11), Pages 503 – 507.

Delete Section 737, Painted Traffic Striping and substitute the following:

Section 737
Painted Traffic Striping

737.01 DESCRIPTION. This work consists of furnishing and applying reflective white or yellow paint for pavement striping, curbs and traffic islands in accordance with plan details, the MUTCD and these specifications.

737.02 MATERIALS. Traffic paint shall be a water-based traffic paint complying with Subsection 1015.12. Glass beads for drop-on application shall comply with Subsection 1015.13.

737.03 EQUIPMENT. Selection of proper equipment to produce satisfactory results within the following requirements shall be the responsibility of the contractor.

(a) Equipment shall permit traffic to pass safely within the limits of the roadway surface and shoulder while operating.

(b) Equipment shall be designed for placement of both solid and broken line stripes of the spacing shown on the plans with square, neat stripe ends. Hand spraying may be used for curbs and traffic islands.

(c) Equipment shall provide a method for cleaning the surface of dust immediately prior to placement of any striping or painting materials.

(d) Equipment shall provide a gravity bead dispenser for drop-on application of glass beads.

(e) The equipment shall provide accurate regulation of the application rate and shall have a tachometer or other approved device to ensure uniform paint application at the designated rate. The equipment shall be adjustable for applying one, two or three adjacent lines simultaneously at the specified spacing and be equipped with a device capable of following a control line. Operation of the unit shall be such that paint will not be spattered or blown on another stripe or outside the prescribed limits during application. The unit shall be designed to properly agitate the paint while in operation.

(f) The equipment may be equipped with a heat exchanger to heat the paint to reduce drying time.

(g) The operation shall include a trailing vehicle equipped with a flashing arrow board.

737.04 CONSTRUCTION. Yellow centerline striping shall be used to delineate traffic moving in opposite directions. White lane line striping shall be used to delineate traffic moving in the same direction. These stripings shall be broken lines and solid lines as required by Part 3 of the MUTCD. Edge lines shall be solid lines, the color of which shall be determined from Part 3 of the MUTCD.

Pavement striping shall be 4 inches (100 mm) in width on all routes. Striping widths for gore markings and turning lanes shall be 8 inches (200 mm) unless noted otherwise in the plans. All lines shall have clean edges with a width tolerance in accordance with Subsection 737.08. The engineer may waive the tolerance when deviations are caused by undulation in the pavement surface.

Broken lines shall be constructed with a stripe-to-gap ratio of a 10-foot (3 m) paint stripe to a 30-foot (9m) gap. The length of the stripe shall be 10 feet (3 m) minimum and 10 1/2 feet (3.2 m) maximum. The stripe-gap cycle shall be 40 feet (12 m) minimum and 40 1/2 feet (12.3 m) maximum.

Curbs and islands shall be painted (yellow or white) as determined in the plans. Paint for curbs and islands may be applied by machine or hand methods as approved by the engineer.

The contractor shall apply all paint on new pavement prior to opening to traffic. When rain or other unavoidable occurrences prevent the marking of pavement, the contractor shall mark the pavement as soon as conditions permit before the roadway is allowed to be open. The requirements of Subsection 713.06 shall govern over the above mentioned application requirements.

737.05 SURFACE PREPARATION. Surfaces to be painted shall be cleaned of materials that may reduce adhesion of paint. Any flaking or peeling material shall be removed by mechanical sweeper or wire brush to the satisfaction of the engineer. Surfaces shall be kept clean and dry at the time of application of paint.

737.06 WEATHER LIMITATIONS. No painting shall be done when:

1. the pavement surface is not thoroughly dried; or,
2. the air is foggy or misty; or,
3. the air or surface temperature is below 50°F (10°C); or,
4. wind or other conditions cause a film of dust to be deposited on the surface after cleaning; or,
5. wind causes displacement of striping material.

737.07 APPLICATION. The longitudinal joint or existing centerline stripe shall be used in determining the location of the centerline of new striping. In the absence of a longitudinal joint or existing stripe, the location of the centerline of new striping shall be located by the contractor with the approval of the engineer. Broken line individual intervals will not be marked. No striping material shall be applied over a guide stringline.

(a) **Paint Preparation:** Immediately before application, paints shall be agitated and mixed thoroughly to a uniform consistency, free from lumps or agglomerates. Paints shall be kept covered to retain volatiles. Paints shall not be thinned without approval. Paint shall be kept thoroughly mixed throughout the application process.

Paint may be heated in heat exchangers to accelerate drying, to a temperature between 110°F and 130°F (43°C and 54°C) for water-based paint.

(b) **Application Rate:** Paint shall be applied at the rate of 25 gallons per mile (59 L/km) at a thickness of 22 wet mils (560 wet μm) and 15 dry mils (380 dry μm) to produce a 4-inch (100 mm) wide solid line. Temporary paint shall be applied at a thickness of 15 wet mils (380 wet μm). Curb and island painting shall be applied at the rate of 12.5 gallons per 100 square yards (57 liters /100 sq m) at a thickness of 15 wet mils (380 wet μm).

Glass beads, complying with Subsection 1015.13, shall be applied at the same time as the paint but in a separate operation at the rate of 90 pounds of beads per 100 square

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yards (49 kg/ 100 sq m). The application of glass beads by the drop-on-method for hand painting shall be at the rate of 72 pounds per 100 square yards (39 kg/100 sq m) of markings or as specified in the plans.

737.08 TOLERANCES. A tolerance of +1/2 inch and -1/8 inch (+13 mm and -3 mm) from the specified width will be allowed, provided the variation is gradual. Segments of broken line may vary ± 6 inches (150 mm) from the specified length provided it is not consistently short. Segments shall be squared off at each end without mist or drip. Longitudinal painted lines shall not deviate from established alignment by more than 1 inch (25 mm) provided the variation does not increase or decrease at the rate of more than 1/2 inch in 25 feet (15 mm in 10 m). Lines not meeting these tolerances shall be removed by abrasive blasting or grinding and replaced at no direct pay.

737.09 PROTECTION OF MARKINGS. Traffic shall be prevented from crossing a wet stripe. The contractor shall use flaggers or other methods to prevent traffic from crossing the wet paint or adjust the operation. Paint that has been marred or picked up by traffic before it has dried shall be repaired by the contractor at no direct pay. The pavement shall be cleaned outside the painted area at no direct pay.

The contractor is not required to maintain striping which has been accepted and opened to traffic.

737.10 PROTECTION OF TRAFFIC. The contractor shall furnish and place all necessary temporary warning and directional signs to direct and protect the traveling public during striping or painting operations.

The pavement striping equipment shall move in the direction of normal traffic flow. The trailing vehicle shall be equipped with an approved flashing arrowboard for directing traffic to the appropriate side during striping operation, when required. Temporary signs, cones and equipment shall be removed from the roadway when striping equipment is not in operation.

Protective and traffic marking devices shall comply with Section 713.

The contractor shall be responsible for resolving all issues related to paint on private vehicles at no direct pay.

737.11 FIELD TESTING OF PAINTED TRAFFIC STRIPING: The Department will field test the pavement markings in accordance with Subsection 1015.12 and Table 737-1. Failure to meet these requirements will require the contractor to provide material and install the portion of the material shown to be out of specifications as directed by the engineer at no cost to the Department.

737.12 CORRECTIVE WORK: Any line or painted area found to be defective shall be restriped or repainted as directed by the engineer. The corrective work shall also be subject to these requirements and as noted in Table 737-2, "Payment Adjustments for Initial Retroreflectivity". The contractor shall restripe or repaint any defective area at no cost to the Department.

737.13 GUARANTEE: All work performed in accordance with this section shall be guaranteed in accordance with Subsection 104.05.

737.14 MEASUREMENT. Painted Traffic Striping will be measured by the mile (km) or linear foot (lin m) as specified. Painted curbs and islands will be measured by the square yard or linear foot. The quantities of traffic paint for payment will be the design quantities specified in the plans and adjustments thereto. The design quantities will be adjusted if the engineer makes changes to adjust to field conditions, if design errors are proven, or if design changes are necessary.

(a) Mile (km): Measurement will be by the mile (km) of single stripe per roadway. No deduction will be made for the standard 30-foot (9 m) design gaps in broken-line striping; however, deductions will be made for the length of other omitted sections.

(b) Linear Foot (Lin m): Measurement will be by the linear foot (lin m), exclusive of gaps.

(c) Square Yard (sq m): Measurement will be by the square yard (sq m) based on horizontal dimensions of the painted area. Quantities will not be adjusted for the vertical faces.

737.15 PAYMENT. Payment for painted traffic striping paint will be made at the contract unit prices and as noted in Table 737-2, "Payment Adjustments for Initial Retroreflectivity".

Payment will be made under:

<u>Item No.</u>	<u>Pay Item</u>	<u>Pay Unit</u>
737-01	Painted Traffic Striping (Solid Line)	Mile (km)
737-02	Painted Traffic Striping (Broken Line)	Mile (km)
737-03	Painted Traffic Striping (Solid Line)	Linear Foot (Lin m)
737-04	Painted Curbs and Islands	Square Yard (Sq m)
737-05	Painted Curbs and Islands	Linear Foot (Lin m)

Table 737-1
Field Testing of Painted Pavement Markings

Length of Roadway	Minimum Required Readings
Less than 1 mile (1.6 km)	10 evenly spaced readings per line type/color ¹
1 mile (1.6 km) to 6 miles (9.6 km)	10 evenly spaced readings per line type/color for each 1 mile (1.6 km) section ¹
Greater than 6 miles (9.6 km)	5 evenly spaced readings per line type/color for each 1 mile (1.6 km) section ²
Legends and Symbols	Visual night time inspection only
8", 16" and 24" Lines	5 readings per line/color ²
¹ Average of 10 readings per set ² Average of 5 readings per set	
<p>Measurements</p> <ol style="list-style-type: none"> Each line type/color will be measured separately. Measurements will be taken on dry, clean roadways. Data will be collected in direction of traffic flow. On broken lines (skip striping), no more than two readings will be taken per stripe, with readings 20 inches (0.5 m) from ends of marking. The Department may take additional readings. Acceptance will be based on the average of each set of readings for each line type/color. Failure of the average reading for any segment to meet the specified minimum values will require replacement, corrective action, or subject to payment adjustments specified in Table 732-2, "Payment Adjustment for Initial Retroreflectivity". Limits of replacement will be determined by the engineer. Line widths 8"; 16"; and 24" will be tested per each location or as directed by the engineer. Retroreflectivity shall match 40 mil (1.0 mm) requirements. Aggregate Surface Course projects will not be tested for retroreflectivity, but will be visual inspected at night for acceptance by the engineer. Multiple lane roadways will require testing of each lane line per mile. 	

Table 737-2
Payment Adjustment for Initial Retroreflectivity

Contract Unit Price ¹ , %	Retroreflectivity Number (Painted Markings)	
	White (mcd\lux\m ²)	Yellow (mcd\lux\m ²)
100	250	175
90	230	165
80	220	155
50 or Restripe	200	150

¹ The payment requirements are based on the project total average of all test segments for initial reading in accordance with Table 737-1.

SECTION 804 – DRIVEN PILES:

Subsection 804.08 – Construction Requirements (04/07), Pages 548 – 554.

Delete the first sentence of Heading (a), Preboring and substitute the following.

Preboring by augering, wet-rotary drilling, or other methods used to facilitate pile driving will not be permitted unless specified in the plans or allowed by the engineer.

Delete the first sentence of Heading (b), Jetting and substitute the following.

Jetting will not be permitted unless allowed in the plans or allowed by the engineer.

SECTION 813 – CONCRETE APPROACH SLABS:

Subsection 813.03 – Embankment (06/08), Pages 688 – 690.

Delete the third paragraph and substitute the following:

When specified, the approach slab shall be placed on a layer of bedding material in accordance with plan details. Bedding material shall be placed and compacted as directed and covered with approved polyethylene film of at least 6-mil (150 µm) nominal thickness.

SECTION 901 – PORTLAND CEMENT CONCRETE:

Subsection 901.06 – Quality Control of Concrete (08/06), Pages 726 – 731.

Add the following to the contents of Heading (b), Quality Control Tests.

The contractor shall be responsible for monitoring the components (cement, mineral and chemical admixtures, aggregates) in their mix to protect against any changes due to component variations. As component shipments arrive, the contractor shall verify slump, air content and set time by testing at ambient temperatures. The contractor shall make adjustments to the mix design to rectify any changes which would adversely affect constructability, concrete placement or the specifications. The contractor shall submit test results to the Department for review each day of paving. Testing to validate component consistency will be documented on the control logs. Conformance or variation in mix parameters (workability, set times, air content, etc.) shall

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be noted on the control logs. The contractor shall provide a copy of the proposed testing plan to the engineer for record. Acceptance of the plan does not relieve the contractor's responsibility for consistency.

Subsection 901.08 – Composition of Concrete (12/05), Pages 732 – 734.

Add the following to Heading (a).

The blended cement containing up to 50 percent of grade 100 or grade 120 ground granulated blast-furnace slag must be in compliance with Subsection 1001.04 for portland blast-furnace slag cement.

SECTION 1001 – HYDRAULIC CEMENT:

Subsection 1001.01 – Portland Cement (09/07), Page 749.

Delete the contents of this subsection and substitute the following.

1001.01 PORTLAND CEMENT. Portland cement shall be from an approved source listed in QPL 7 and shall comply with AASHTO M 85.

Alkali content calculated as sodium oxide equivalent shall not exceed 0.60 percent by weight for all types of cement.

SECTION 1002 – ASPHALT MATERIALS AND ADDITIVES:

Subsection 1002.02 – Asphalt Material Additives (04/08), Pages 750 – 760.

Delete Table 1002-1, Performance Graded Asphalt Cements and substitute the following.

Table 1002-1
Performance Graded Asphalt Cements

Property	AASHTO Test Method	PG82-22rm ⁶	PG76-22m	PG70-22m	PG64-22	PG58-28
		Spec.	Spec.	Spec.	Spec.	Spec.
Tests on Original Binder:						
Rotational Viscosity @ 135°C, Pa·s ¹	T 316	3.0	3.0	3.0	3.0	3.0
Dynamic Shear, 10 rad/s, G*/Sin Delta, kPa	T 315	1.00+ @ 82°C	1.00+ @ 76°C	1.00+ @ 70°C	1.30+ @ 64°C	1.00+ @ 58°C
Flash Point, °C	T 48	232+	232+	232+	232+	232+
Solubility, % ²	T 44	N/A	99.0+	99.0+	99.0+	99.0+
Separation of Polymer, 163°C, 48 hours, degree C difference in R & B from top to bottom ⁵	ASTM D 7173 AASHTO T 53	---	2-	2-	---	---
Force Ductility Ratio (f ₂ /f ₁ , 4°C, 5 cm/min., f ₂ @ 30 cm elongation) ³	T 300	---	0.30+	---	---	---
Force Ductility, (4°C, 5 cm/min, 30 cm elongation, kg) ³	T 300	---	---	0.23+	---	---
Tests on Rolling Thin Film Oven Residue:	T 240					
Mass loss, %	T 240	1.00-	1.00-	1.00-	1.00-	1.00-
Dynamic Shear, 10 rad/s, G*/Sin Delta, kPa	T 315	2.20+ @ 82°C	2.20+ @ 76°C	2.20+ @ 70°C	2.20+ @ 64°C	2.20+ @ 58°C
Elastic Recovery, 25°C, 10 cm elongation, % ⁴	T 301	60+	60+	40+	---	---
Ductility, 25°C, 5 cm/min, cm	T 51	---	---	---	90+	---
Tests on Pressure Aging Vessel Residue:	R 28					
Dynamic Shear, @ 25°C, 10 rad/s, G* Sin Delta, kPa	T 315	5000-	5000-	5000-	5000-	5000- @ 19°C
Bending Beam Creep Stiffness, S, MPa @ -12°C.	T 313	300-	300-	300-	300-	300- @ -18°C
Bending Beam Creep Slope, m value, @ -12°C	T 313	0.300+	0.300+	0.300+	0.300+	0.300+ @ -18°C

¹The rotational viscosity will be measured to determine product uniformity. The rotational viscosity measured by the supplier shall be noted on the Certificate of Delivery. A binder having a rotational viscosity of 3.0 Pa·s or less will typically have adequate mixing and pumping capabilities. Binders with rotational viscosity values higher than 3.0 Pa·s should be used with caution and only after consulting with the supplier as to any special handling procedures and guarantees of mixing and pumping capabilities.

²Not all polymers are soluble in the specified solvents. If the polymer modified asphalt digested in the solvent will not pass the filter media, a sample of the base asphalt used in making the polymer modified asphalt should be tested for solubility. If the solubility of the base asphalt is at least 99.0%, the material will be considered as passing.

³AASHTO T 300 except the second peak (f₂) is defined as the stress at 30 cm elongation.

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⁴AASHTO T 301 except elongation shall be 10 cm.

⁵Prepare samples per ASTM D 7173. Determine softening point of top and bottom per AASHTO T 53.

⁶The quality assurance plan for this product will require the contractors who use this material to submit written documentation of tank cleaning annually. Contractors must have tank mixers. Written certificates of analysis from the asphalt binder supplier confirming rubber source and size distribution of rubber used shall be furnished to the Materials Laboratory.

Add the following Table 1002-12, Anionic Trackless Tack Coat Grade NTSS-1HM.

Table 1002-12
Anionic Trackless Tack Coat Grade NTSS-1HM

Property	AASHTO Test Method	Specification Deviation	
		100% Pay	50% Pay or Remove ¹
Viscosity, Saybolt Furol @ 25°C, s	T 59	15 - 100	---
Storage Stability, 24 Hour, %	T 59	1.0-	---
Settlement, 5 Days, %	T 59	5.0-	---
Residue by Distillation, %	T 59	50+	49-
Oil Distillate, %	T 59	1.0-	---
Sieve Test ² , (Retained on the 850 µm), %	T 59	0.3-	---
Tests on Residue			
Penetration @ 25°C, 100g, 5s, dmm	T 49	20-	---
Softening Point, Ring and Ball, °C	T 53	65+	64-
Solubility, %	T 44	97.5+	---
DSR @ 82°C; G*/Sin δ, 10 rad / s, kPa	T 315	1.0+	---

¹ At the option of Engineer.

² Sieve tests may be waived if no application problems are present in the field.

SECTION 1003 – AGGREGATES:

Subsection 1003.02 – Aggregates for Portland Cement Concrete and Mortar (07/07).

Pages 763 – 766.

Delete the contents of Heading (c), Aggregates for Types B and D Pavements, and substitute the following.

(c) Aggregates for Types B and D Pavements: For the combined aggregates for the proposed portland cement concrete pavement mix, the percent retained based on the dry weight (mass) of the total aggregates shall meet the requirements of Table 1003-1A for the type of pavement specified in the plans. Additionally, the sum of the percents retained on any two adjacent sieves so designated in the table shall be at least 12 percent of the total combined aggregates. The maximum amounts by weight (mass) of deleterious materials for the total aggregate shall be the same as shown in Subsection 1003.02(b).

Table 1003-1A
Aggregates for Types B and D Pavements

U.S. Sieve	Metric Sieve	Percent Retained of Total Combined Aggregates	
		Pavement Type	
		Type B	Type D
2 1/2 inch	63 mm	0	0
2 inch	50 mm	0	0-20
1 1/2 inch	37.5 mm	0-20	0-20
1 inch	25.0 mm	0-20	5-20
3/4 inch	19.0 mm	5-20	5-20
1/2 inch	12.5 mm	5-20	5-20
3/8 inch	9.5 mm	5-20	5-20
No. 4	4.75 mm	5-20	5-20
No. 8	2.36 mm	5-20	5-20
No. 16	1.18 mm	5-20	5-20
No. 30	600 µm	5-20	5-20
No. 50	300 µm	0-20	0-20
No. 100	150 µm	0-20	0-20
No. 200	75 µm	0-5	0-5
Note: For the sieves in the shaded areas, the sum of any two adjacent sieves shall be a minimum of 12 percent of the total combined aggregates.			

Each type of aggregate to be used in the proposed mixture shall be sampled and tested individually. The percent of total combined aggregates retained shall be determined mathematically based on the proportions of the combined aggregate blend. All gradation calculations shall be based on percent of dry weight (mass).

Subsection 1003.03 – Base Course Aggregates (07/08), Page 767 – 768.

Add the following:

(e) Blended Calcium Sulfate: When blended calcium sulfate base course material is allowed on the plans, it shall consist of calcium sulfate from a source approved by the Materials and Testing Section and be blended with an approved aggregate or lime. The source shall have a quality control program approved by the Materials and Testing Section. The source shall have been given environmental clearance by the Department of Environmental Quality for the intended use, and written evidence of such environmental clearance shall be on file at the Materials and Testing Section. DOTD monitoring for compliance with environmental regulations will be limited to the pH testing stated herein below. The blended material shall be non-plastic and reasonably free from organic and foreign matter. The pH shall be a minimum of 5.0 when tested in accordance with DOTD TR 430. Re-evaluation will be required if the source of the aggregate or lime that is blended with the calcium sulfate changes.

Blended calcium sulfate material used as base course shall comply with the following gradation requirements when tested in accordance with DOTD TR 113, modified to include a

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maximum drying temperature of 140°F (60°C). Sampling shall be taken from an approved stockpile at the point of origin.

<u>U.S. Sieve</u>	<u>Metric Sieve</u>	<u>Percent Passing</u>
1-1/2 inch	37.5 mm	60 - 100
1 inch	25.0 mm	40 - 80
3/4 inch	19.0 mm	30 - 70
No. 4	4.75 mm	20 - 65
No. 200	75 µm	0 - 25

Blended calcium sulfate shall be sampled in accordance with the requirements for stone in Section 302 of the Materials Sampling Manual.

Subsection 1003.09 – Nonplastic Embankment (03/09), Pages 775 and 776.

Delete Heading (b) and substitute the following.

(b) Stone: Stone shall be coarse stone from a source listed on QPL 2. For applications requiring lightweight embankment, the stone shall have a dry rodded unit weight (mass) of no greater than 95 pounds per cubic foot (1520 kg/cu m) when tested in accordance with AASHTO T19. Stone shall comply with the following gradation:

<u>U.S. Sieve</u>	<u>Metric Sieve</u>	<u>Percent Passing</u>
2 inch	50 mm	100
1 1/2 inch	37.5 mm	85 - 100
3/4 inch	19.0 mm	35 - 88
No. 4	4.75 mm	0 - 10

SECTION 1005 – JOINT MATERIALS FOR PAVEMENTS AND STRUCTURES:

Subsection 1005.04 – Combination Joint Former/Sealer (11/05), Pages 782 and 783.

Delete Heading (a) and substitute the following.

(a) Description: This joint former/sealer is intended for use in simultaneously forming and sealing a weakened plane in portland cement concrete pavements.

The material shall consist of an elastomeric strip permanently bonded either mechanically or chemically at the top of each of two rigid plastic side frames and covered with a removable plastic top cap. Side frames shall be of such configuration that when the sealer is inserted into plastic concrete and vibrated, a permanent bond forms between side frames and concrete.

Delete Heading (b)(1) and substitute the following.

(1) Elastomer: The elastomer strip portion of the material shall be manufactured from vulcanized elastomeric compound using polymerized chloroprene or thermoplastic vulcanizate as the base polymer, and shall comply with the following requirements:

<u>Property</u>	<u>ASTM Test Method</u>	<u>Requirements</u>	
		<u>Polymerized Chloroprene</u>	<u>Thermoplastic Vulcanizate</u>
Tensile Strength, kPa, Min.	D 412	12,400	7,400
Elongation at Break, % Min.	D 412	200	400
Hardness, Shore A	D 2240	65 ± 10	65 ± 10
Properties after Aging, 70 h @ 100°C	D 573		
Tensile Strength, % Loss, Max.		20	20
Elongation, % loss, Max.		25	25
Hardness, pts. increase, Max.		10	10
Ozone Resistance, 20% strain or bentloop,			
300 pphm in air, 70 h @ 40°C	D 1149	no cracks	no cracks
Oil Swell, IRM 903, 70 h			
@ 100°C, wt change, % Max.	D 471	45	75

Delete Headings (b)(2) and (b)(3) and substitute the following:

(2) Bond of Elastomer to Plastic: The force required to shear the elastomer from the plastic shall be a minimum of 5.0 pounds per linear inch (90 g/mm) of sealer when tested in accordance with DOTD TR 636.

(3) Bond of Plastic to Cement Mortar: This bond will be evaluated and shall meet the following requirements:

The force required to separate the cement mortar from the plastic shall be a minimum of 5.0 pounds per linear inch (90 g/mm) of sealer when tested in accordance with DOTD TR 636.

SECTION 1006 – CONCRETE AND PLASTIC PIPE:

Subsection 1006.09 – Plastic Yard Drain Pipe (06/07), Page 789.

Delete the contents of Subheading (a)(3), Ribbed Polyvinyl Chloride Pipe (RPVCP) and substitute the following.

Ribbed Polyvinyl Chloride Pipe (RPVCP): Ribbed Polyvinyl Chloride Pipe shall comply with ASTM F 794, Series 46 or ASTM F 949 (46 psi).

SECTION 1013 – METALS:

Subsection 1013.09 – Steel Piles (08/06) Page 822.

Delete the title and references to “Steel Piles” in this subsection and substitute “Steel H Piles”.

SECTION 1015 – SIGNS AND PAVEMENT MARKINGS:

All subsections within Section 1015 (10/11), Pages 831 – 849.

Delete Section 1015, Signs and Pavement Markings and substitute the following:

Section 1015
Signs and Pavement Markings

1015.01 GENERAL REQUIREMENTS. The materials shall comply with these specifications, the plans and the MUTCD. When directed, the contractor shall furnish and prepare samples for testing in accordance with Department instructions.

1015.02 METALS.

(a) Ferrous Metals:

(1) Structural Steel: Structural steel for posts, stringers, framing and miscellaneous steel shall comply with AASHTO M 270, Grade 36 (M 270M, Grade 250). Steel shall be galvanized in accordance with Subsection 811.12.

(2) Steel Pipe: Steel pipe or tubing for structures shall be Schedule 40 (STD) complying with ASTM A 53, Type E or Type S Grade B, or hot formed tubing complying with ASTM A 36 (ASTM A 36M) and ASTM A 501.

(3) Steel Posts for Small Signs, Markers and Delineators: Posts shall be steel of the flanged channel type shown on the plans, galvanized after fabrication in accordance with Subsection 811.12. Before fabrication, posts shall be within 3.5 percent of the specified weight (mass).

Posts shall be fabricated from steel complying with either ASTM A 499, Grade 60 with chemical properties conforming to ASTM A 1 for 91 -lb/yd (45 kg/m) or heavier rail steel, or ASTM A 576, Grade 1080 with 0.10 percent -0.20 percent silicon. Holes 3/8 inch (10 mm) in diameter shall be drilled or punched through the middle of each post on one inch (25-mm) centers for at least 36 inches (900 mm) from the top of each post.

(b) Aluminum Alloy: Structural members shall be aluminum complying with ASTM B 221 (ASTM B 221M) or ASTM B 429, Alloy 6061-T6. Miscellaneous aluminum shall comply with ASTM B 209 (ASTM B 209M), Alloy 6061-T6.

(c) Fittings:

(1) Structural Bolts, Nuts and Washers: High strength bolts shall be ASTM A 325 (ASTM A 325M), and other bolts shall be ASTM A 307, Grade A or Grade B. Bolts shall have hexagonal heads and be supplied with two flat and one lock washer and hexagonal-head nut. Bevel washers, where required, shall be wrought steel. Bolts, nuts and washers shall be galvanized in accordance with ASTM A 153 or by an approved mechanical galvanizing process complying with ASTM B 695 that provides the same coating thickness.

Anchor bolts shall be AASHTO M 270, Grade 36 (M 270M, Grade 250) steel except the maximum tensile strength shall be 88,000 psi (605 MPa) and galvanized in accordance with Subsection 811.12 unless otherwise specified.

Stainless steel bolts shall comply with ASTM A 320 (ASTM A 320M), Grade B 8, annealed or approved equal.

(2) Fasteners: Fasteners used in fabricating sign faces, including splice plates for joining two panels, sills and border angles, and attaching route marker shields shall be 1/4 inch (6 mm) aluminum blind rivets that provide positive mandrel retention. These rivets shall have a minimum tensile strength of 875 pounds (397 kg) and a minimum sheer strength of 850 pounds (386 kg).

Fasteners, used in attaching Interstate, Louisiana, and U.S. shields to the sign panel, shall be manufactured from aluminum alloy with brasier heads, complying with ASTM B 316 (ASTM B 316M), Alloy 2024-T4.

Fasteners used in attaching demountable legend to sign faces (except for shields) shall be 1/8 inch (3 mm) diameter blind rivets manufactured from aluminum alloy complying with ASTM B 316 (ASTM B 316M), Alloy 1100-H14.

Fasteners for delineator, object marker and milepost assemblies shall be vandal resistant and will be subject to approval prior to use.

1015.03 FLEXIBLE POSTS. Flexible posts for small signs, markers and delineators shall be approved products listed in QPL 39.

1015.04 SIGN PANELS.

(a) Permanent Sign Panels: Flat panels shall be aluminum sheets or plates complying with ASTM B 209, Alloy 6061-T6 or Alloy 5052-H38. Extruded aluminum panels shall comply with ASTM B 221 (ASTM B 221M), Alloy 6063-T6 and after fabrication, have a flatness equal to or less than 0.031 inch per foot of length and 0.004 inch per inch of width.

(b) Temporary Sign Panels: Substrate for barricade panels shall be either wood or rigid thermoplastic. Substrate for portable signs shall be aluminum, wood or plastic. Substrate for post mounted signs shall be aluminum, wood, rigid thermoplastic or aluminum clad low density polyethylene plastic.

(1) Aluminum: Aluminum sheeting shall be 0.080 inch (2 mm) thickness complying with ASTM B 209 (ASTM B 209M), Alloy 6061-T6 or Alloy 5052-H38.

(2) Wood: Plywood sheeting of exterior type Grades either High Density Overlay or Medium Density Overlay, are acceptable for use provided the following requirements are met.

Panels shall be a minimum of 5/8 inch (15 mm) thick and shall comply with the latest American Plywood Association specifications and be identified with the APA edge mark or back stamp to verify inspection and testing. Prior to application of reflective sheeting, the surface shall be abraded with steel wool or fine sandpaper, and wiped thoroughly clean. The surface shall be allowed to dry a minimum of 8 hours prior to application of sheeting. Cut edges of plywood panels shall be sealed with an approved aluminum pigmented polyurethane sealer.

(3) Plastic: Plastic substrate for barricade panels and signs shall be as follows.

a. Fiber Reinforced Vinyl (PVC): The substrate shall have a nominal composite thickness of 0.04 inches (1 mm) and be bonded to an approved retroreflective material by the manufacturer.

b. Rigid Thermoplastic: Rigid thermoplastic substrate shall consist of either High Density Polyethylene (HDPE) or High Density Polycarbonate (HDPC). The rigid thermoplastic for barricade panels shall be hollow core HDPE or HDPC with a minimum

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thickness of 0.625 inch (16 mm). The thermoplastic for sign panels shall be either 0.40 inch (10 mm) thick thin wall, fluted substrate or 0.625 inch (16 mm) thick blow molded substrate. Substrates shall be sufficiently rigid to maintain a flat face and shall be capable of attachment to the sign mounting in such a manner as not to crush or otherwise deform the substrate. Reflectorized sheeting applied to rigid thermoplastic shall have its manufacturer's approval for use on the substrate.

c. Aluminum Clad Low Density Polyethylene (AL/LDPE) Plastic: The aluminum clad low density polyethylene plastic substrate shall be 0.080 inch (2 mm) thick. The substrates shall be sufficiently rigid to maintain a flat face and shall be capable of attachment to the sign mounting in such a manner as not to crush or otherwise deform the substrate. Reflectorized sheeting applied to aluminum clad low density polyethylene shall have its manufacturer's approval for use on this substrate.

1015.05 REFLECTIVE SHEETING.

(a) Permanent and Temporary Standard Sheeting: Reflective sheeting shall be one of the following standard types as specified on the plans and complying with ASTM D 4956 except as modified herein. Permanent warning, regulatory, guide and supplemental guide sign sheeting shall meet the requirements of DOTD Type X as detailed below. Reflective sheeting for temporary signs and devices shall meet the requirements of ASTM D 4956 Type III except as noted in Subsection 1015.05(f). Reflective sheeting shall be an approved product listed in QPL 13.

Type III - A high-intensity retroreflective sheeting that is typically encapsulated glass-bead retroreflective material.

Type VI - An elastomeric, high-intensity retroreflective sheeting without adhesive. This sheeting is typically a vinyl microprismatic retroreflective material.

Type X - A super high-intensity retroreflective sheeting having highest retroreflectivity characteristics at medium distances. This sheeting is typically an unmetalized microprismatic retroreflective element material.

(b) Fluorescent Pink Retroreflective Sheeting: Signs for temporary control of traffic through incident management areas shall be Type VI fluorescent pink retroreflective sheeting and shall comply with the MUTCD. Temporary traffic control signs for incident management shall be placed to notify motorists of upcoming incidents on the roadway, and shall be removed from public view once the incident has been managed. Physical properties shall comply with ASTM D 4956. Photometric properties shall be as follows.

(1) Retroreflectivity: Minimum Coefficients of Retroreflection shall be as specified in Table 1015-1.

Table 1015-1
Coefficients of Retroreflection for Fluorescent Pink Sheeting¹

Observation Angle, degrees	Entrance Angle, degrees	Fluorescent Pink
0.2	-4	100
0.2	+30	40
0.5	-4	40
0.5	+30	15

¹Minimum Coefficient of Retroreflection (R_A) ($\text{cd lx}^{-1}\text{m}^{-2}$)

(2) Color and Daytime Luminance: Color Chromaticity Coordinates and Daytime Luminance Factors shall be as specified in Table 1015-2.

Table 1015-2
Fluorescent Pink Color Specifications Limits (Daytime)

Chromaticity Coordinates (corner points) ¹								Luminance Factor, min.
1		2		3		4		Y%
x	y	x	y	x	Y	x	y	25
0.450	0.270	0.590	0.350	0.644	0.290	0.536	0.230	

¹The four pairs of chromaticity coordinates measured with CIE 2° Standard Observer and 45/0 (0/45) geometry and CIE D65 Standard Illuminant.

(c) DOTD Type X Retroreflective Sheeting: Physical properties shall comply with ASTM D 4956. Color shall conform to ASTM D 4956, Table 11. Luminance shall conform to ASTM D 4956, Table 2. Retroreflectivity properties shall be as follows:

(1) Retroreflectivity: Minimum Coefficients of Retroreflection shall be as specified in Table 1015-1A.

Table 1015-1A
Coefficients of Retroreflection for DOTD Type X Sheeting¹

Observation Angle, (degrees)	0.2	0.2	0.5	0.5
Entrance Angle, (degrees)	-4	+30	-4	+30
White	560	280	200	100
Yellow	420	210	150	75
Orange	210	105	75	37
Green	56	28	20	10
Red	84	42	30	15
Blue	28	14	10	5.0
Brown	17	8.4	6.0	3.0
Fluorescent Yellow-Green	450	220	160	80
Fluorescent Yellow	340	170	120	60
Fluorescent Orange	170	84	60	30

¹Minimum Coefficient of Retroreflection (R_A) ($\text{cd lx}^{-1}\text{m}^{-2}$)

(d) Adhesive Classes: The adhesive required for retroreflective sheeting shall be Class 1 (pressure sensitive) as specified in ASTM D 4956.

(e) Accelerated Weathering: Reflective sheeting, when processed, applied and cleaned in accordance with the manufacturer's recommendations shall perform in accordance with the accelerated weathering standards in Table 1015-3.

Table 1015-3
Accelerated Weathering Standards¹

Type	Retroreflectivity ²				Colorfastness ³	
	Orange/ Fluorescent Orange		All colors, except Orange/ Fluorescent Orange		Orange/ Fluorescent Orange	All colors, except Orange/ Fluorescent Orange
III	1 year	80 ⁴	3 years	80 ⁴	1 year	3 years
III (for drums)	1 year	80 ⁴	1 year	80 ⁴	1 year	1 year
VI	1/2 year	50 ⁵	1/2 year	50 ⁵	1/2 year	1/2 year
DOTD X	1 year	80 ⁶	3 years	80 ⁶	1 year	3 years

¹At an angle of 45° from the horizontal and facing south in accordance with ASTM G 7 at an approved test facility in Louisiana or South Florida.

²Percent retained retroreflectivity of referenced table after the outdoor test exposure time specified.

³Colors shall conform to the color specification limits of ASTM D 4956 after the outdoor test exposure time specified.

⁴ASTM D 4956, Table 4.

⁵ASTM D 4956, Table 7.

⁶Table 1015-1A.

(f) Expected Sign Life Data and Performance: The sheeting manufacturer shall supply expected retroreflectivity service life curves for each of the following sign sheeting colors: white, green, blue, brown, red, and yellow. The service life curves shall be plots of the 95 percent expected life plotted on an 'x-y' graph with life years on the 'x-axis' and retroreflectivity on the 'y-axis'. The expected life shall account for worst-case installations, equivalent to an installation in South Louisiana with the sign facing to the South. The sheeting manufacturer shall also supply a table of expected life values taken from the service life curves for Revision Number 2 to the 2003 Edition of the MUTCD minimum reflectivity requirements published in the Federal Register on December 21, 2007.

Reflective sheeting for signs, when processed, applied and cleaned in accordance with the manufacturer's recommendations shall perform outdoors in accordance with the performance standards in Table 1015-4.

Table 1015-4
Reflective Sheeting Performance Standards

Type	Retroreflectivity ¹ -- Durability ²				Colorfastness ³
	Orange/ Fluorescent Orange		All colors, except orange/Fluorescent Orange		
III	3 years	80 ⁴	10 years	80 ⁴	3 years
DOTD X	3 years	80 ⁵	7 years	80 ⁵	3 years

¹Percent retained retroreflectivity of referenced table after installation and the field exposure time specified.

²All sheeting shall maintain its structural integrity, adhesion and functionality after installation and the field exposure time specified.

³All colors shall conform to the color specification limits of ASTM D 4956 after installation and the field exposure time specified.

⁴ASTM D 4956, Table 4.

⁵Table 1015-1A.

(g) Temporary Signs, Barricades, Channelizing Devices, Drums and Cones: Reflective sheeting for temporary signs, barricades and channelizing devices, shall meet the requirements of ASTM D 4956, Type III except that temporary warning construction signs used on the mainline of freeways and expressways shall be fluorescent orange and meet the requirements of DOTD Type X.

Reflective sheeting for vertical panels shall meet the requirements of ASTM D 4956, Type III.

Reflective sheeting for drums shall be a minimum of 6 inches (150 mm) wide and shall meet the requirements of ASTM D 4956, Type III, and the Supplementary Requirement S2 for Reboundable Sheeting as specified in ASTM D 4956. Reflective sheeting for traffic cone collars shall meet the requirements of ASTM D 4956, Type III or Type VI.

(h) Sheeting Guaranty. The contractor shall provide the Department with a guaranty from the sheeting manufacturer stating that if the retroreflective sheeting fails to comply with the performance requirements of this subsection, the sheeting manufacturer shall do the following:

Table 1015-5
Manufacturer's Guaranty-Reflective Sheeting

Type	Manufacturer shall restore the sign face in its field location to its original effectiveness at no cost to the Department if failure occurs during the time period ¹ as specified below		Manufacturer shall replace the sheeting required to restore the sign face to its original effectiveness at no cost to the Department if failure occurs during the time period ¹ as specified below
	Orange/Fluorescent Orange	All colors, except orange/Fluorescent Orange	All colors, except orange/Fluorescent Orange
III	<3 years	<7 years	7-10 years
DOTD X	<3 years	<5 years	5-7 years

¹ From the date of sign installation.

Replacement sheeting for sign faces, material, and labor shall carry the unexpired guaranty of the sheeting for which it replaces.

The sign fabricator shall be responsible for dating all signs with the month and year of fabrication at the time of sign fabrication. This date shall constitute the start of the guaranty obligation period.

1015.06 NONREFLECTIVE SHEETING.

(a) General Requirements: Nonreflective sheeting film shall consist of an extensible, pigmented, weather-resistant plastic film. Face side of film shall be supported and protected by a paper liner which is readily removable after application without the necessity of soaking in water or other solvents. Colors shall be matched visually and be within the limits shown in Table 17 of ASTM D 4956.

(b) Adhesive Requirements: Sheeting shall have a pre-coated pressure sensitive adhesive backing or a tack-free heat-activated adhesive backing, either of which may be applied without additional coats on either sheeting or application surface. Adhesive shall comply with ASTM D 4956, Class 1 (pressure sensitive).

(c) Physical Characteristics: The film shall be readily cut by normal fabricating methods without cracking, checking or flaking. Applied film shall be free from ragged edges, cracks and blisters. The material shall have demonstrated its ability to withstand normal weathering without checking, cracking or excessive color loss.

1015.07 SIGN ENAMELS, PAINTS, SILK SCREEN PASTE AND OVERLAY FILM.

(a) Sign Enamels and Paints: These shall be applied in accordance with the sheeting manufacturer's recommendations. Final appearance as well as materials used shall be subject to approval.

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(b) Silk Screen Paste: Constituents used in manufacture of silk screen paste shall meet approval of the engineer. Silk screen paste shall be mixed at the factory, well ground to a uniform consistency and smooth texture, and shall be free from water and other foreign matter. It shall dry within 18 hours to a film that does not run, streak, or sag. Paste which has livered, hardened or thickened in the container, or in which pigment has settled out so that it cannot be readily broken up with a paddle to a uniform usable consistency, will be rejected. Paste and thinner shall be used in accordance with the sheeting manufacturer's recommendations.

Paste shall have proper pigmentation and consistency for use in silk screen equipment. The material shall produce the desired color and the same retroreflectivity values as required for reflective sheeting of the same type and color when applied on reflective sheeting background. Paste shall meet the quality and test requirements for appearance, coarse particles, and moisture and water resistance as specified for sign paints.

(c) Overlay Film: Transparent electronic cuttable overlay film shall produce the desired color and the same reflectivity values as required for reflective sheeting of the same type and color when applied on reflective sheeting background.

1015.08 TEMPORARY PAVEMENT MARKINGS.

(a) Temporary Tape: Temporary tape shall comply with ASTM D 4592, Type I (removable) or Type II (non-removable) and shall be an approved product listed in QPL-60.

(b) Painted Stripe: Paint shall be an approved traffic paint complying with Subsection 1015.12. Glass beads for drop-on application shall comply with Subsection 1015.13.

(c) Temporary Raised Pavement Markings for Asphaltic Surface Treatment: Temporary raised pavement markers for asphaltic surface treatment shall be flexible reflective tabs having a nominal width of 4 inches (10 cm). The markers shall be yellow with amber reflective area on both sides. The body of the marker shall consist of a base and vertical wall made of polyurethane or other approved material and shall be capable of maintaining a reasonable vertical position after installation. The initial minimum Coefficient of Luminous Intensity at an entrance angle of -4 degrees and an observation angle of 0.2 degrees shall be 230 mcd/lx when measured in accordance with ASTM E 810.

The reflective material shall be protected with an easily removable cover of heat resistant material capable of withstanding and protecting the reflective material from the application of asphalt at temperatures exceeding 325°F (160°C).

1015.09 RAISED PAVEMENT MARKERS. Markers shall be either nonreflectorized or reflectorized, as specified. Markers shall be approved products listed in QPL 9. Infrared curves of materials used in markers shall match approved curves on file at the Department's Materials and Testing Section.

(a) Nonreflectorized Markers:

(1) Description: Nonreflectorized markers shall consist of an acrylonitrile butadiene styrene polymer or other approved material, and shall be 4-by-6-inches (100-by-150-mm).

(2) Physical Requirements: Markers shall comply with the compressive strength requirements of ASTM D 4280. The color shall be in accordance with the plans and the MUTCD.

(b) Reflectorized Markers: Reflectorized markers shall comply with ASTM D 4280, Designation H and Designation F. The type and color shall be in accordance with the plans and the MUTCD. The markers shall be either standard having approximate base dimensions of 4-by-4-inches (100-by-100-mm) and a maximum height of 0.80 inches (20 mm) or low profile having approximate base dimensions of 4-by-2-inches (100-by-50-mm) and a maximum height of 0.60 inches (15 mm).

(c) Adhesive:

(1) Epoxy Adhesive: Epoxy adhesive shall be Type V epoxy resin system complying with Subsection 1017.02.

(2) Bituminous Adhesive: The adhesive shall conform to ASTM D 4280 for asphaltic surfaces and D 4280 Type II or Type III for concrete surfaces and shall be an approved product listed in QPL 59.

1015.10 THERMOPLASTIC PAVEMENT MARKINGS.

(a) Description: This specification covers hot-sprayed, hot-extruded, and preformed thermoplastic reflective compound for pavement markings on asphaltic or portland cement concrete pavement. Thermoplastic marking material applied to asphaltic surfaces shall consist of an alkyd based formulation. Thermoplastic marking material applied to portland cement concrete surfaces shall consist of either an alkyd based or hydrocarbon based formulation. Material shall be so manufactured as to be applied by spray (40 mil (1.0 mm)) or extrusion (90 mil (2.3 mm)) to pavement in molten form, with internal and surface application of glass spheres, and upon cooling to normal pavement temperature, shall produce an adherent, reflectorized pavement marking of specified thickness and width, capable of resisting deformation. Black thermoplastic marking material shall be used according the standard plans on all Portland cement concrete pavement. This material shall not require glass beads. Material shall not scorch, break down, or deteriorate when held at the plastic temperature specified in Subsection 732.03(f) (1) for 4 hours or when reheated four times to the plastic temperature. Temperature-vs.-viscosity characteristics of plastic material shall remain constant when reheated four times, and shall be the same from batch to batch. There shall be no obvious change in color of material as the result of reheating four times or from batch to batch.

For yellow thermoplastic material, the type and amount of yellow pigment shall be at the option of the manufacturer, providing all other requirements of this specification are met. However, the pigment for yellow thermoplastic shall be lead free and shall meet the regulatory level of non-hazardous waste as defined by 40 CFR 261.24 when tested in accordance with EPA Method 1311, toxicity Characteristics Leaching Procedures. The manufacturer shall provide certification that the material provided meets these requirements.

(b) Suitability for Application: Thermoplastic material shall be a product especially compounded for pavement markings. Markings shall maintain their original dimension and placement and shall not smear or spread under normal traffic at temperatures below 140°F (60°C). Markings shall have a uniform cross section. Pigment shall be evenly dispersed

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throughout the material thickness. The exposed surface shall be free from tack and shall not be slippery when wet. Material shall not lift from pavement in freezing weather. Cold ductility of material shall be such as to permit normal movement with the pavement surfaced without chipping or cracking.

(c) Standard (Flat) 90 mil (2.3 mm) or Greater Thermoplastic Pavement Markings: White and yellow thermoplastic shall be approved products listed in QPL 63 and shall comply with AASHTO M 249 as modified herein. All other colors are not required to be on the QPL.

(1) Color:

a. Laboratory Performance: The yellow thermoplastic shall comply with the requirements of Table 1015-6 when tested in accordance with ASTM E 1349.

Table 1015-6
Color Specification Limits (Daytime)

Color	1		2		3		4	
	x	y	x	y	x	y	x	y
Yellow	0.4756	0.4517	0.4985	0.4779	0.5222	0.4542	0.4919	0.4354

(The four pairs of chromaticity coordinates determine the acceptable color in terms of the CIE 1931 Standard Colorimetric System measured with Standard 2° Observer and Standard Illuminant D65.)

b. Field Performance: The initial daytime color and luminance factor (Cap Y) readings may be taken by the Department, as required by the engineer, within 7 to 30 days after installation to verify compliance with ASTM D 6628.

(2) Whiteness Index: The white thermoplastic shall have a minimum whiteness index of 40 when tested according to ASTM E 313.

(3) Filler: For black thermoplastic, the filler to be incorporated with the resins shall be a white calcium carbonate, silica, or any approved equivalent.

(4) Retroreflectivity: Within 30 days of application, the initial retroreflectivity readings shall be taken by the contractor with a DOTD inspector present during testing. Upon completion of the testing the DOTD inspector shall immediately take possession of a copy of the retroreflectivity readings in either hard copy (8-1/2 inch by 11 inch) or electronic format as noted below. Additionally, documentation shall be provided to the Department that the instrument has been calibrated per manufacturer's requirements.

For each material type, a different set of readings shall be taken in accordance with Table 732-1, "Field Testing of Plastic Pavement Markings" in Section 732. If the data was provided in hard copy as noted above, the data shall be given to the Department in electronic Microsoft Excel® (xls) format downloaded from the reflectometer data within 30 days. Each spreadsheet shall have a header that states all of the following:

1. Project number;
2. Date material installed;
3. Type of material installed; and
4. The beginning mile-point to ending mile-point of material installed.

The format for the excel spreadsheet shall be (description, date, and reading). In the description cell the format shall be Route (i.e. LA, US, or I), Direction (i.e. N, S, E, or W), Mile Point and Color (W or Y).

Examples:

LA 115W; 23; Y.
I-10; S; 4; W.

For 90 mil thermoplastic, the initial retroreflectance for the in-place marking shall have a minimum retroreflectance value of 375 mcd/lux/sq m for white and 250 mcd/lux/sq m for yellow. Readings taken by the Department before the expiration of the Guarantee Period of Subsection 104.05 shall be at least 325 mcd/lux/sq m or greater for white and 200 mcd/lux/sq m or greater for yellow when measured with a geometry of 1.05 degrees observation angle and 88.76 degrees entrance angle.

Black thermoplastic pavement markings shall not require any reflectivity testing.

For pavement legends and symbols and non-lane delineation striping, the initial retroreflectance for the in-place markings shall be in accordance with Section 732, Table 732-2.

(d) Standard (Flat) 40 mil (1.0 mm) Thermoplastic Pavement Markings: Materials shall comply with AASHTO M 429 as modified herein:

(1) Composition: The material shall meet the following composition requirements:

	White	Yellow
Binder	25 percent minimum	25 percent minimum
Glass Spheres	30 percent minimum	30 percent minimum

% by weight (mass)

The intermix glass spheres contained in the thermoplastic material shall conform to AASHTO M 247 Type I.

(2) Color:

a. Laboratory Performance: The yellow thermoplastic shall comply with the requirements of Table 1015-6, "Color Specification Limits (Daytime)" when tested in accordance with ASTM E 1349.

b. Field Performance: The initial daytime color and luminance factor (Cap Y) reading may be taken by the Department, as required by the engineer, within 7 to 30 days after installation to verify compliance with ASTM D 6628.

(3) Softening Point: After heating the marking compound for 4 hours \pm 5 min. at 375°F \pm 3°F (190°C \pm 2°C) and testing in accordance with ASTM E 28, the material shall have a minimum softening point of 190°F (88°C) as measured by the ring and ball method.

(4) Indentation Resistance: The material, when tested in accordance with ASTM D 2240, Shore Durometer, A2, shall not exceed 40 when tested at 115°F \pm 3°F (46.1°C \pm 2°C).

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(5) Retroreflectivity: Within 30 days of application, the initial retroreflectivity readings shall be taken by the contractor with a DOTD inspector present during testing. Upon the completion of the testing the DOTD inspector will immediately take possession of a copy of the retroreflectivity readings in either hard copy (8-1/2 inch by 11 inch) or electronic format as noted below. Additionally, documentation shall be provided to the Department that the instrument has been calibrated per manufacturer's requirements.

For each material type, a different set of readings shall be taken in accordance with Table 732-1, "Field Testing of Plastic Pavement Markings" in Section 732. If the data was provided in hard copy as noted above, the data shall be given to the Department in electronic Microsoft Excel® (xls) format downloaded from the reflectometer data within 30 days. Each spreadsheet shall have a header that states all of the following:

1. Project number;
2. Date material installed;
3. Type of material installed; and,
4. The beginning mile-point to ending mile-point of material installed.

The format for the excel spreadsheet shall be (description, date, and reading). In the description cell the format shall be Route (i.e. LA, US, or I), Direction (i.e. N, S, E, or W), Mile Point and Color (W or Y).

Examples:

LA 115W; 23; Y
I-10; S; 4; W.

For 40 mil thermoplastic, initial retroreflectance for the in-place marking shall have a minimum retroreflectance of 250 mcd/lux/sq m for white and 175 mcd/lux/sq m for yellow when measured at a geometry of 1.05 degrees observation angle and 88.76 degrees entrance angle (30 m geometry), as detailed in ASTM E 1710. Readings taken by the Department before the expiration of the Guarantee Period of Subsection 104.05 shall be at least 200 mcd/lux/sq m or greater for white and 125 mcd/lux/sq m or greater for yellow when measured with a geometry of 1.05 degrees observation angle and 88.76 degrees entrance angle.

(e) 125 mil (3.2 mm) Thermoplastic Pavement Markings: Materials shall comply with AASHTO M 429 as modified herein:

Thickness of material not including drop on beads shall not be less than 125 mils (3.2mm) for gore markings, crosswalks, stop lines, word and symbol markings. This material can be applied either by standard thermoplastic or preformed thermoplastic material.

Extruded or Ribbon Thermoplastic Materials shall comply with the same requirements in 1015.10(c).

Preformed Thermoplastic Material shall be approved products listed on QPL 76.

1015.11 PREFORMED PLASTIC PAVEMENT MARKING TAPE.

(a) General: Preformed plastic pavement marking tape shall be approved products listed on QPL 64 and shall comply with ASTM D4505 Retroreflectivity Level I or Level II, or DOTD Intersection Grade (as specified below), except as modified herein. The marking tape shall be Class 2 or 3. The type and color shall be in accordance with the plans and the MUTCD.

(b) Thickness: All preformed plastic pavement marking tape shall have a minimum overall thickness of 0.060 inches (1.5 mm) when tested without the adhesive.

(c) Friction Resistance: The surface of the Retroreflectivity Level II preformed plastic pavement marking tape shall provide a minimum frictional resistance value of 35 British Polish Number (BPN) when tested according to ASTM E303. The surface of the Retroreflectivity Level I and DOTD Intersection Grade preformed plastic pavement marking tape shall provide a minimum frictional resistance value of 45 BPN when tested according to ASTM E 303. Values for the Retroreflectivity Level I material with a raised surface pattern as defined in ASTM D 4505 are calculated by averaging values taken at downweb and at a 45 degrees angle from downweb.

(d) Retroreflective Requirements: The preformed plastic pavement marking tape shall have the minimum initial specific luminance values shown in Table 1015-7 when measured in accordance with ASTM D 4061.

Table 1015-7
Specific Luminance of Preformed Plastic Tape

Type	Observation Angle, degrees	Entrance Angle, degrees	Specific Luminance (mcd/sq m/lx)	
			White	Yellow
Retroreflectivity Level I	1.05	88.76	500	300
DOTD Intersection Grade	1.05	88.76	375	250
Retroreflectivity Level II	1.05	88.76	250	175

(e) Durability Requirements: The DOTD Intersection Grade preformed plastic pavement marking tape shall show no appreciable fading, lifting or shrinkage for at least 12 months after placement when placed in accordance with the manufacturer's recommended procedures on pavement surfaces having a daily traffic count not to exceed 15,000 ADT per lane.

The Retroreflectivity Level I preformed plastic pavement marking tape shall show no appreciable fading, lifting or shrinkage for at least 4 years after placement for longitudinal lines and at least 2 years after placement for symbols and legends.

The Retroreflectivity Level I preformed plastic pavement marking tape shall also retain the following reflectance values for the time period detailed in Table 1015-8.

Table 1015-8
 Retained Specific Luminance for Retroreflectivity Level I
 Preformed Plastic Pavement Marking Tape

Time	Observation Angle, degrees	Entrance Angle, degrees	Specific Luminance (mcd/sq m/lx)	
			White	Yellow
1 year	1.05	88.76	400	240
4 years (2 years for symbols and legend)	1.05	88.76	100	100

(f) Plastic Pavement Marking Tape Guaranty (DOTD Intersection Grade and Retroreflectivity Level I): If the plastic pavement marking tape fails to comply with the performance and durability requirements of this subsection within 12 months for DOTD Intersection Grade and 4 years for Retroreflectivity Level I, the manufacturer shall replace the plastic pavement marking material at no cost to the Department.

1015.12 TRAFFIC PAINT. The contractor shall use water-borne traffic paint. The same type paint shall be used throughout the project. Each paint container shall bear a label with the name and address of manufacturer, trade name or trademark, type of paint, number of gallons, batch number and date of manufacture.

Paints shall be approved products listed in QPL 36, shall show no excessive settling, caking or increase in viscosity during 6 months of storage, and shall be readily stirred to a suitable consistency for standard spray gun application.

An infrared curve shall be generated in accordance with DOTD TR 610 and compared with the standard curve made during the initial qualification process.

For yellow paint material, the type and the amount of yellow pigment shall be at the option of the manufacturer, providing all of the requirements of this specification are met. However, the pigment for yellow paint shall be lead free and shall meet the regulatory level of non-hazardous waste as defined by 40 CFR 261.24 when tested in accordance with EPA Method 1311, Toxicity Characteristics Leaching Procedures. The manufacturer shall provide certification that the material provided meets these requirements.

(a) Vacant

(b) Water Borne Traffic Paint: This material shall be a rapid setting waterborne compound suitable for use with hot application equipment. The paint shall contain Rohm & Hass Rhoplex Fastrack HD-21, an emulsion with 48.5 percent solids content, Dow DT 400NA acrylic emulsion with 49.5 – 51.5 percent solids content, or approved equal. The material shall meet the requirements of Table 1015-10.

Table 1015-10
Water Borne Traffic Paint Physical Properties

<u>Property</u>	<u>Test Method</u>	<u>Requirements</u>	
		<u>Min.</u>	<u>Max.</u>
pH	ASTM E 70	9.9	---
Viscosity, at 25°C Krebs Unit	ASTM D 562	78	95
Drying Time, minutes ¹	ASTM D 711	---	10
Total Solids, % by mass	ASTM D 2369	73	79
Percent Pigment ²	ASTM D 3723	55	62
Nonvolatiles in Vehicle, % by weight	ASTM D 215	43	---
Weight per Gallon, lb/gal	ASTM D 1475	---	---
White		13.7	---
Yellow		13.1	---
Daylight Reflectance, %	ASTM E 1349		
White		80	---
Yellow		50	---
Fineness of Grind	ASTM D 1210	3	---
Color	3	Pass	
Shelf Life, months		12	---
Pigment Composition	4	Pass	
Infrared Spectroscopy (IR)	DOTD TR 610	Pass	

¹Drying time to no track - Paint applied at 15 mils (375 µm) wet on the road surface with paint heated to 120-150°F (50-65°C) shall not show tracking when a standard size automobile crosses in a passing maneuver at 3 minutes.

² No theoretical empirical factor shall be applied in determining the percent of the paint. Percent pigment shall not be calculated by adding back the burned-off organic constituents of the pigment.

³Color (without glass beads) - Yellow paint shall comply with the requirements of Table 1015-11 when tested in accordance with ASTM E 1349. White shall be a clean, bright, untinted binder.

⁴The white paint shall contain a minimum of 1.0 pound per gallon (120 g/L) of rutile titanium dioxide (TiO₂) as determined using DOTD TR 523. The rutile titanium dioxide shall comply with ASTM D 476.

Table 1015-11
Water Borne Traffic Paint Color Specification Limits (Daytime)

Color	1		2		3		4	
	x	y	x	y	x	y	x	y
Yellow	0.493	0.473	0.518	0.464	0.486	0.428	0.469	0.452

(The four pairs of chromaticity coordinates determine the acceptable color in terms of the CIE 1931 Standard Colorimetric System measured with Standard 2° Observer and Standard Illuminant D65.)

(c) Initial Retroreflectivity: Within 30 days of application, the initial retroreflectivity readings shall be taken by the contractor with a DOTD inspector present during testing. Upon completion of the testing, the DOTD inspector shall immediately take possession of a copy of the retroreflectivity readings in either hard copy (8-1/2 inch by 11 inch) or electronic format as noted below. Additionally, documentation shall be provided to the Department that the instrument has been calibrated per manufacturer's requirements.

For each material type a different set of readings shall be taken in accordance with Table 737-1, "Field Testing of Painted Pavement Markings" in Section 737. If the data was provided in hard copy as noted above, the data shall be given to the Department in electronic Microsoft Excel® (xls) format downloaded from the reflectometer data within 30 days. Each spreadsheet shall have a header that states all of the following:

1. Project number;
2. Date material installed;
3. Type of material installed; and,
4. The beginning mile-point to ending mile-point of material installed.

The format for the excel spreadsheet shall be (description, date, and reading). In the description cell the format shall be Route (i.e. LA, US, or I), Direction (i.e. N, S, E, or W), Mile Point and Color (W or Y).

Examples:

LA 115W; 23; Y
I-10; S; 4; W.

For traffic paint, initial retroreflectance shall have a minimum retroreflectance of 250 mcd/lux/sq m for white and 175 mcd/lux/sq m for yellow when measured with geometry of 1.05 degrees observation angle and 88.76 degrees entrance angle (30 m geometry).

(d) Initial Daytime Color and Luminance Factor: For traffic paint, the initial daytime color and luminance factor (Cap Y) will be tested according to and in compliance with the requirements of ASTM D6628. Readings may be taken by the Department from 7 to 30 days after installation to verify compliance with ASTM 6628.

1015.13 GLASS BEADS FOR PAVEMENT MARKINGS. Glass beads for use with painted traffic striping and flat thermoplastic striping shall be transparent, clean, colorless glass, smooth and spherically shaped, free from milkiness, pits, or excessive air bubbles and conform to the specific requirements for the class designated. The beads shall conform to the specification requirements of AASHTO M 247 as modified herein.

(a) Moisture Resistance - Flow Characteristics: The beads shall not absorb moisture in storage. They shall remain free of clusters and lumps and shall flow freely from the dispensing equipment.

(b) Gradation: The testing for gradation of the beads shall be in accordance with ASTM D 1214 and shall meet the gradation requirements of AASHTO M 247, Section 4.1., for the specified type of beads.

(1) Painted Traffic Striping: Glass beads for painted traffic striping shall meet the gradation requirements of AASHTO M 247 Type 3. Table 1015-12A, "Gradation of Refractive Index Glass Beads" may be used as an alternate on chip seal.

Table 1015-12A
Gradation of 1.9 Refractive Index Glass Beads

U.S. SIEVE (METRIC SIEVE)	PERCENT RETAINED
No. 18 (1.00 mm)	0-5
No. 20 (850 µm)	5-15
No. 30 (600 µm)	10-30
No. 40 (425 µm)	20-40
No. 50 (300 µm)	20-40
PAN	0-5

(2) Flat Profile Thermoplastic Striping: Drop-on beads for flat profile thermoplastic striping shall meet the gradation requirements of Table 1015-13; AASHTO M 247, Type 1, 2, or 4; or Table 1015-12A as determined by the thickness of the striping specified in Table 1015-13.

Table 1015-13
Types of AASHTO M 247 Glass Beads used for
Flat Profile Thermoplastic Striping

THICKNESS	NUMBER OF BEAD DROPS	APPLICATION #1	APPLICATION #2
40 mil spray	Single Drop	AASHTO M247 Type 2 or Table 1015-12A	N/A
90 mils or greater	Double Drop	AASHTO M247 Type 4	AASHTO M 247 Type 1 or Table 1015-12A

(3) 40 mil Spray Thermoplastic Striping: Drop-on beads for 40 mil spray thermoplastic striping shall meet the gradation requirements of Table 1015-13. Table 1015-12A may be used as an alternative.

(c) Roundness: Beads shall have a minimum of 80 percent rounds per screen for the two (2) highest sieve sizes. The remaining sieve sizes shall have no less than 75 percent rounds. AASHTO M 247 Type 1 and Type 2 beads shall be tested according to ASTM D 1155. Other types shall be tested by microscopic examination.

(d) Angular Particles: The beads shall have no more than three (3) percent angular particles per screen.

(e) Refractive Index: The beads shall have a refractive index of 1.50 to 1.52 when tested by the liquid immersion method. Beads conforming to Table 1015-12A shall have a minimum refractive index of 1.90.

(f) Embedment Coating: The large beads for thermoplastic striping shall be coated with an adhesion assuring coating. The smaller AASHTO M 247 Type 1 beads shall be coated to provide free flowing characteristics when tested in accordance with AASHTO M 247 Section 5.3., and assure adhesion. Glass beads shall be properly coated and conform to the requirements when tested as described in DOTD TR 530 Determination of Embedment Coating on Large Embedment Coated Glass Beads for Pavement Markings.

(g) Packaging and Marking: The beads shall be packaged in moisture proofed containers. Each container shall be stamped with the following information: Name and address of manufacturer, shipping point, trademark or name, the wording "Large Embedment Coated Glass Beads", class, weight, lot number and the month and year of manufacture. The container for the AASHTO M 247 Type 1 beads shall be similarly stamped except that the wording shall be "Glass Beads".

(h) Heavy Metal Limits: All glass beads shall not contain more than 75 parts per million of inorganic arsenic, when tested using EPA Method 6010B in conjunction with EPA Method 3052 for sample preparation.

SECTION 1020 – TRAFFIC SIGNALS:

Subsection 1020.01 – Traffic Signal Heads (06/07), Pages 873 – 884.

Delete the contents of Heading (a), General Requirements and substitute the following:

(a) General Requirements: Traffic signal sections, beacon sections and pedestrian signal sections shall be of the adjustable type. Materials and construction of each section shall be the same.

Signals shall be constructed for either 8 or 12-inch (200 mm or 300 mm) lens in accordance with the plans. Signal sections shall have three to five sections per face and beacon sections have only one section per face. Signal sections and associated brackets shall be finished inside and out with two coats of high grade dark olive green enamel, color number 14056 according to Federal Standard No. 595b with each coat independently baked. Visors shall be coated green on the outside and black on the inside. Edges shall be deburred and smooth with no sharp edges.

Subsection 1020.04 – Poles for Traffic Signal Systems (06/07), Pages 890 – 894.

Delete the sixth paragraph of Heading (a), Pedestal Support Signal Poles, and substitute the following.

Pedestals shall be finished with at least one coat of rustproofing primer, applied to a clean surface and one coat of dark olive green enamel, color number 14056 according to Federal Standard No. 595.

**LOUISIANA
DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
SUPPLEMENTAL SPECIFICATIONS**

FEMALE AND MINORITY PARTICIPATION IN CONSTRUCTION

The following notice shall be included in, and shall be a part of, all solicitations for offers and bids on all federal and federally assisted construction contracts or subcontracts in excess of \$10,000 to be performed in geographical areas designated by the director of OFCCP. Execution of the contract by the successful bidder and any subsequent subcontracts will be considered the contractor's and subcontractor's commitment to the EEO provisions contained in this notice.

**NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION
TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY
(EXECUTIVE ORDER 11246)**

1. The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Opportunity Construction Contract Specifications" set forth herein.
2. The goals for minority and female participation, expressed in percentage terms for the contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

AREA	PARISH OR COUNTY	GOAL (%)
FEMALE PARTICIPATION		
-	All Covered Areas	6.9
MINORITY PARTICIPATION (UNDER NEW ORLEANS PLAN)		
-	* See Note Below	20 to 23
MINORITY PARTICIPATION (NOT UNDER NEW ORLEANS PLAN)		
1	Jefferson LA, Orleans LA, St. Bernard LA, St. Tammany LA	31.0
2	Assumption LA, Lafourche LA, Plaquemines LA, St. Charles LA, St. James LA, St. John the Baptist LA, Tangipahoa LA, Terrebonne LA, Washington LA, Forrest MS, Lamar MS, Marion MS, Pearl River MS, Perry MS, Pike MS, Walthall MS	27.7
3	Ascension LA, East Baton Rouge LA, Livingston LA, West Baton Rouge, LA	26.1
4	Concordia LA, East Feliciana LA, Iberville, LA, Pointe Coupee LA, St. Helena LA, West Feliciana LA, Adams MS, Amite MS, Wilkinson, MS	30.4
5	Lafayette LA	20.6
6	Acadia LA, Evangeline LA, Iberia LA, St. Landry LA, St. Martin LA, St. Mary LA, Vermillion LA	24.1
7	Calcasieu LA	19.3
8	Allen LA, Beauregard LA, Cameron LA, Jefferson Davis LA, Vernon LA	17.8
9	Grant LA, Rapides LA	25.7
10	Avoyelles LA, Bienville LA, Bossier LA, Caddo LA, Claiborne LA, DeSoto LA, Natchitoches LA, Red River LA, Sabine LA, Webster LA, Winn LA	29.3
11	Ouachita LA	22.8
12	Caldwell LA, Catahoula LA, East Carroll LA, Franklin LA, Jackson LA, LaSalle LA, Lincoln LA, Madison LA, Morehouse LA, Richland LA, Tensas LA, Union LA, West Carroll LA,	27.9

*These goals apply only to those contractors signatory to the New Orleans Plan and only with respect to those trades which have unions participating in said Plan. The New Orleans Plan Covered Area is as follows: The parishes of Orleans, Jefferson, St. Bernard, St. Tammany, St. Charles, St. John the Baptist, Plaquemines, Washington, Terrebonne, Tangipahoa (that area east of the Illinois Central Railroad), Livingston (that area southeast of the line from a point off the Livingston and Tangipahoa Parish line adjacent from New Orleans and Baton Rouge), St. James (that area southeast of a line drawn from the Town of Gramercy to the point of intersection of St. James, Lafourche and Assumption Parishes), and Lafourche.

These goals are applicable to all the contractor's construction work (whether or not it is federal or federally assisted) performed in the covered area. If the contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the contractor is also subject to the goals for both its federally involved and non-federally involved construction.

The contractor's compliance with the Executive Order and the regulations in 41 CFR 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a), and its efforts to meet the goals established for the geographical area where the contract resulting from this solicitation is to be performed. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the contractor shall make good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from contractor to contractor, or from project to project, for the purpose of meeting the contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 CFR 60-4. Compliance with the goals will be measured against the total work hours performed.

3. The contractor shall provide written notification to the Regional Administrator of the Office of Federal Contract Compliance Programs (555 Griffin Square Building, Dallas, TX 75202) within 10 working days of award of any construction subcontract in excess of \$10,000 at any tier for construction work under the contract. The notification shall list the name, address and telephone number of the subcontractor; employer identification number; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and geographical area in which the contract is to be performed.

4. As used in this Notice and in the contract, the "covered area" is that area shown in the foregoing table in which the project is located.

The following Standard Federal Equal Employment Opportunity Construction Contract Specifications (Executive Order 11246) shall be included in, and shall be a part of, all solicitations for offers and bids on all federal and federally assisted construction contracts or subcontracts in excess of \$10,000. Execution of the contract by the successful bidder and any

subsequent subcontracts will be considered the contractor's and subcontractor's commitment to the EEO provisions contained in these Standard Federal Equal Employment Opportunity Construction Contract Specifications (Executive Order 11246).

**STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY
CONSTRUCTION CONTRACT SPECIFICATIONS
(EXECUTIVE ORDER 11246)**

1. As used in these specifications:
 - a. "Covered area" means the geographical area described in the solicitation from which this contract resulted;
 - b. "Director" means Director, Office of Federal Contract Compliance Programs, United States Department of Labor, or any person to whom the Director delegates authority;
 - c. "Employer identification number" means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U. S. Treasury Department Form 941.
 - d. "Minority" includes:
 - (i) Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);
 - (ii) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race);
 - (iii) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and
 - (iv) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).
2. If the contractor, or any subcontractor at any tier, subcontracts a portion of the work involving any construction trade, he shall include in each subcontract in excess of \$10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation.
3. If the contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each contractor or subcontractor participating in an approved Plan is required to comply with his obligations under the EEO clause, and to make good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other contractor or subcontractors toward a goal in an

approved Plan does not excuse any covered contractor's or subcontractor's failure to take good faith efforts to achieve the Plan goals.

4. The contractor shall implement the specific affirmative action standards provided in paragraphs 7a through 7p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. Covered construction contractors performing construction work in geographical areas where they do not have a federal or federally assisted construction contract shall apply the minority and female goals established for the geographical area where the work is being performed. Goals are published periodically in the Federal Register in notice form, and such notices may be obtained from any OFCCP office or from federal procurement contracting officers. The contractor is expected to make substantially uniform progress in meeting its goals in each craft during the period specified.

5. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the contractor has a collective bargaining agreement, to refer either minorities or women, shall excuse the contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.

6. In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the contractor during the training period, and the contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U. S. Department of Labor.

7. The contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the contractor's compliance with these specifications will be based on his effort to achieve maximum results from its actions. The contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:

- a. Ensure and maintain a working environment free of harassment, intimidation and coercion at all sites, and in all facilities at which the contractor's employees are assigned to work. The contractor, where possible, will assign 2 or more women to each construction project. The contractor shall ensure that all foremen, superintendents and other on-site supervisory personnel are aware of and carry out the contractor's obligation to maintain such a working environment with specific attention to minority or female individuals working at such sites or in such facilities.
- b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to

- community organizations when the contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.
- c. Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the contractor by the union or, if referred, not employed by the contractor, this shall be documented in the file with the reason therefor, along with whatever additional actions the contractor has taken.
 - d. Provide immediate written notification to the Director when the union or unions with which the contractor has a collective bargaining agreement has not referred to the contractor a minority person or woman set by the contractor, or when the contractor has other information that the union referral process has impeded the contractor's efforts to meet its obligations.
 - e. Develop on-the-job training opportunities and/or participate in training programs for the area which include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the contractor's employment needs, especially those programs funded or approved by the Department of Labor. The contractor shall provide notice of these programs to the sources compiled under 7b above.
 - f. Disseminate the contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the contractor in meeting his EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.
 - g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination or other employment decisions including specific review of these items with on-site supervisory personnel such as superintendent, general foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.
 - h. Disseminate the contractor's EEO policy externally by including it in any advertising in the news media, including minority and female news media, and providing written notification to and discussing the contractor's EEO policy with other contractors and subcontractors with whom the contractor does or anticipates doing business.
 - i. Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the contractor's recruitment area and employment needs. Not later than 1 month prior to the date for the acceptance of

applications for apprenticeship or other training by any recruitment source, the contractor shall send written notification to organizations such as the above describing the openings, screening procedures and tests to be used in the selection process.

- j. Encourage present minority and female employees to recruit other minority persons and women, and where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of a contractor's workforce.
- k. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR 60-3.
- l. Conduct, at least annually, an inventory and evaluation of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.
- m. Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the contractor's obligations under these specifications are being carried out.
- n. Ensure that all facilities and company activities are non-segregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.
- o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.
- p. Conduct a review, at least annually, of all supervisors' adherence to and performance under the contractor's EEO policies and affirmative action obligations.

8. Contractors are encouraged to participate in voluntary associations which assist in fulfilling their affirmative action obligations (7a through p). The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the contractor is a member and participant, may be asserted as fulfilling its obligations under 7a through 7p of these specifications provided that the contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the contractor's minority and female workforce participation, makes a good faith effort to meet his goals and timetables and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the contractor. The obligation to comply, however, is the contractor's and failure of such a group to fulfill an obligation shall not be a defense for the contractor's noncompliance.

9. A goal for minorities and a separate goal for women have been established. The contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the contractor may be in violation of the Executive Order if a group is employed

in a substantially disparate manner (for example, even though the contractor has achieved its goals for women generally, the contractor may be in violation of the Executive Order if a minority group of women is underutilized).

10. The contractor shall not use the goals or affirmative action standards to discriminate against any person because of race, color, religion, sex or national origin.

11. The contractor shall not enter into a subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

12. The contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.

13. The contractor, in fulfilling his obligations under these specifications, shall implement specific affirmative actions steps, at least as extensive as the standards prescribed in paragraph 7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the contractor fails to comply with the requirements of the Executive Order, the implementing regulations or these specifications, the Director shall proceed in accordance with 41 CFR 60-4.8.

14. The contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice, trainee helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors will not be required to maintain separate records.

15. Nothing herein shall be construed as a limitation on the application of other laws which establish different standards of compliance or on the application of requirements for hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

16. In addition to the reporting requirements set forth elsewhere in this contract, the contractor and subcontractors holding subcontracts (not including material suppliers) in excess of \$10,000

shall submit for every month of July during which work is performed, employment data as contained under Form FHWA-1391 in accordance with instructions included thereon.

**LOUISIANA
DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
SUPPLEMENTAL SPECIFICATIONS**

NEW ORLEANS PLAN

Each bidder, contractor or subcontractor (hereinafter called the contractor) must fully comply with these bid conditions as to each construction trade intended to be used on this construction contract and all other construction work (both federal and nonfederal) in New Orleans Plan Area during the performance of this contract or subcontract. The contractor commits to the minority and female employment utilization goals set forth herein and all other requirements, terms and conditions expressed herein by submitting a properly signed bid.

The contractor shall appoint a company executive to assume the responsibility for implementation of the requirements, terms and conditions of these bid conditions.

These specifications implementing the New Orleans Plan for employment of minorities and females have been imposed by the U. S. Department of Labor by order on September 8, 1971, as amended, for all nonexempt federal and federally assisted construction contracts to be awarded in the area of jurisdiction of the Southeast Louisiana Building and Construction Trades Council in the City of New Orleans and Southeast Louisiana. This area consists of the parishes of Orleans, Jefferson, St. Bernard, St. Tammany, St. Charles, St. John the Baptist, Plaquemines, Washington, Terrebonne, Tangipahoa (that area east of the Illinois Central Railroad), Livingston (that area southeast of the line from a point off the Livingston and Tangipahoa Parish line adjacent from New Orleans and Baton Rouge), St. James (that area southeast of a line drawn from the Town of Gramercy to the point of intersection of St. James, Lafourche and Assumption Parishes), and Lafourche.

The provisions of these bid conditions apply to contractors which are party to collective bargaining agreements with labor organizations which together have agreed to the New Orleans Area Construction Program (hereinafter called the New Orleans Plan) for equal opportunity and have jointly made a commitment to goals of minority and female utilization. The New Orleans Plan is a voluntary agreement between (1) Southeast Louisiana Building and Construction Trades Council; (2) contractors and subcontractors who are signatory to the New Orleans Plan; (3) the Urban League of Greater New Orleans and representatives of the minority community; and (4) the City of New Orleans. The New Orleans Plan, together with all implementing agreements that have been and may hereafter be developed pursuant thereto, are incorporated herein by reference.

The requirements set forth herein shall constitute the specific affirmative action requirements for activities under this contract and supplement the equal employment opportunity requirements set forth in the Required Contract Provisions.

The contractor and all subcontractors holding contracts in excess of \$10,000 shall comply with the following minimum requirement activities of equal employment opportunity. The contractor shall include these requirements in every subcontract in excess of \$10,000 with such modification of language as necessary to make them binding on the subcontractor.

Each contractor and subcontractor shall submit a monthly employment utilization report, Standard Form 257, covering the contractor's entire work force employed on all contracts (both federal and nonfederal) held in the New Orleans Area. In addition, a list of the federal and nonfederal contracts which are covered by the report shall be furnished. The report shall be submitted to the engineer no later than the 10th day following the end of the month being reported. The report shall end on the next to the last Saturday in the month being reported and shall reflect all hours worked between this date and the close out date in the preceding month. Copies of all payrolls and personnel data shall be retained for 3 years after final acceptance of the project. These records and documents, or copies thereof, shall be made available at reasonable times and places for inspection by an authorized representative of the State or Federal Government and shall be submitted upon request with any other compliance information which such representative may require.

In addition to the reporting requirements set forth above, the contractor and the subcontractors holding subcontracts, not including material suppliers, in excess of \$10,000 shall submit for every month of July during which work is performed, employment data as contained under Form FHWA-1391, and in accordance with the instructions included thereon.

A contractor may be in compliance with these bid conditions by its participation in the New Orleans Plan and applicable provisions contained in the "Notice of Requirement for Affirmative Action to Ensure Equal Employment Opportunity (Executive Order 11246)" and Standard Federal Equal Employment Opportunity Construction Contract Specifications (Executive Order 11246).

REQUIRED CONTRACT PROVISIONS FEDERAL-AID CONSTRUCTION CONTRACTS

- I. General
- II. Nondiscrimination
- III. Nonsegregated Facilities
- IV. Davis-Bacon and Related Act Provisions
- V. Contract Work Hours and Safety Standards Act Provisions
- VI. Subletting or Assigning the Contract
- VII. Safety: Accident Prevention
- VIII. False Statements Concerning Highway Projects
- IX. Implementation of Clean Air Act and Federal Water Pollution Control Act
- X. Compliance with Governmentwide Suspension and Debarment Requirements
- XI. Certification Regarding Use of Contract Funds for Lobbying

ATTACHMENTS

A. Employment and Materials Preference for Appalachian Development Highway System or Appalachian Local Access Road Contracts (included in Appalachian contracts only)

I. GENERAL

1. Form FHWA-1273 must be physically incorporated in each construction contract funded under Title 23 (excluding emergency contracts solely intended for debris removal). The contractor (or subcontractor) must insert this form in each subcontract and further require its inclusion in all lower tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services).

The applicable requirements of Form FHWA-1273 are incorporated by reference for work done under any purchase order, rental agreement or agreement for other services. The prime contractor shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.

Form FHWA-1273 must be included in all Federal-aid design-build contracts, in all subcontracts and in lower tier subcontracts (excluding subcontracts for design services, purchase orders, rental agreements and other agreements for supplies or services). The design-builder shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.

Contracting agencies may reference Form FHWA-1273 in bid proposal or request for proposal documents, however, the Form FHWA-1273 must be physically incorporated (not referenced) in all contracts, subcontracts and lower-tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services related to a construction contract).

2. Subject to the applicability criteria noted in the following sections, these contract provisions shall apply to all work performed on the contract by the contractor's own organization and with the assistance of workers under the contractor's immediate superintendence and to all work performed on the contract by piecework, station work, or by subcontract.

3. A breach of any of the stipulations contained in these Required Contract Provisions may be sufficient grounds for withholding of progress payments, withholding of final payment, termination of the contract, suspension / debarment or any other action determined to be appropriate by the contracting agency and FHWA.

4. Selection of Labor: During the performance of this contract, the contractor shall not use convict labor for any purpose within the limits of a construction project on a Federal-aid highway unless it is labor performed by convicts who are on parole, supervised release, or probation. The term Federal-aid highway does not include roadways functionally classified as local roads or rural minor collectors.

II. NONDISCRIMINATION

The provisions of this section related to 23 CFR Part 230 are applicable to all Federal-aid construction contracts and to all related construction subcontracts of \$10,000 or more. The provisions of 23 CFR Part 230 are not applicable to material supply, engineering, or architectural service contracts.

In addition, the contractor and all subcontractors must comply with the following policies: Executive Order 11246, 41 CFR 60, 29 CFR 1625-1627, Title 23 USC Section 140, the Rehabilitation Act of 1973, as amended (29 USC 794), Title VI of the Civil Rights Act of 1964, as amended, and related regulations including 49 CFR Parts 21, 26 and 27; and 23 CFR Parts 200, 230, and 633.

The contractor and all subcontractors must comply with: the requirements of the Equal Opportunity Clause in 41 CFR 60-1.4(b) and, for all construction contracts exceeding \$10,000, the Standard Federal Equal Employment Opportunity Construction Contract Specifications in 41 CFR 60-4.3.

Note: The U.S. Department of Labor has exclusive authority to determine compliance with Executive Order 11246 and the policies of the Secretary of Labor including 41 CFR 60, and 29 CFR 1625-1627. The contracting agency and the FHWA have the authority and the responsibility to ensure compliance with Title 23 USC Section 140, the Rehabilitation Act of 1973, as amended (29 USC 794), and Title VI of the Civil Rights Act of 1964, as amended, and related regulations including 49 CFR Parts 21, 26 and 27; and 23 CFR Parts 200, 230, and 633.

The following provision is adopted from 23 CFR 230, Appendix A, with appropriate revisions to conform to the U.S. Department of Labor (US DOL) and FHWA requirements.

1. Equal Employment Opportunity: Equal Employment Opportunity (EEO) requirements not to discriminate and to take affirmative action to assure equal opportunity as set forth under laws, executive orders, rules, regulations (28 CFR 35, 29 CFR 1630, 29 CFR 1625-1627, 41 CFR 60 and 49 CFR 27) and orders of the Secretary of Labor as modified by the provisions prescribed herein, and imposed pursuant to 23 U.S.C. 140 shall constitute the EEO and specific affirmative action standards for the contractor's project activities under

this contract. The provisions of the Americans with Disabilities Act of 1990 (42 U.S.C. 12101 et seq.) set forth under 28 CFR 35 and 29 CFR 1630 are incorporated by reference in this contract. In the execution of this contract, the contractor agrees to comply with the following minimum specific requirement activities of EEO:

a. The contractor will work with the contracting agency and the Federal Government to ensure that it has made every good faith effort to provide equal opportunity with respect to all of its terms and conditions of employment and in their review of activities under the contract.

b. The contractor will accept as its operating policy the following statement:

"It is the policy of this Company to assure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, sex, color, national origin, age or disability. Such action shall include: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship, pre-apprenticeship, and/or on-the-job training."

2. EEO Officer: The contractor will designate and make known to the contracting officers an EEO Officer who will have the responsibility for and must be capable of effectively administering and promoting an active EEO program and who must be assigned adequate authority and responsibility to do so.

3. Dissemination of Policy: All members of the contractor's staff who are authorized to hire, supervise, promote, and discharge employees, or who recommend such action, or who are substantially involved in such action, will be made fully cognizant of, and will implement, the contractor's EEO policy and contractual responsibilities to provide EEO in each grade and classification of employment. To ensure that the above agreement will be met, the following actions will be taken as a minimum:

a. Periodic meetings of supervisory and personnel office employees will be conducted before the start of work and then not less often than once every six months, at which time the contractor's EEO policy and its implementation will be reviewed and explained. The meetings will be conducted by the EEO Officer.

b. All new supervisory or personnel office employees will be given a thorough indoctrination by the EEO Officer, covering all major aspects of the contractor's EEO obligations within thirty days following their reporting for duty with the contractor.

c. All personnel who are engaged in direct recruitment for the project will be instructed by the EEO Officer in the contractor's procedures for locating and hiring minorities and women.

d. Notices and posters setting forth the contractor's EEO policy will be placed in areas readily accessible to employees, applicants for employment and potential employees.

e. The contractor's EEO policy and the procedures to implement such policy will be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.

4. Recruitment: When advertising for employees, the contractor will include in all advertisements for employees the notation: "An Equal Opportunity Employer." All such advertisements will be placed in publications having a large circulation among minorities and women in the area from which the project work force would normally be derived.

a. The contractor will, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employee referral sources likely to yield qualified minorities and women. To meet this requirement, the contractor will identify sources of potential minority group employees, and establish with such identified sources procedures whereby minority and women applicants may be referred to the contractor for employment consideration.

b. In the event the contractor has a valid bargaining agreement providing for exclusive hiring hall referrals, the contractor is expected to observe the provisions of that agreement to the extent that the system meets the contractor's compliance with EEO contract provisions. Where implementation of such an agreement has the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Federal nondiscrimination provisions.

c. The contractor will encourage its present employees to refer minorities and women as applicants for employment. Information and procedures with regard to referring such applicants will be discussed with employees.

5. Personnel Actions: Wages, working conditions, and employee benefits shall be established and administered, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff, and termination, shall be taken without regard to race, color, religion, sex, national origin, age or disability. The following procedures shall be followed:

a. The contractor will conduct periodic inspections of project sites to insure that working conditions and employee facilities do not indicate discriminatory treatment of project site personnel.

b. The contractor will periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.

c. The contractor will periodically review selected personnel actions in depth to determine whether there is evidence of discrimination. Where evidence is found, the contractor will promptly take corrective action. If the review indicates that the discrimination may extend beyond the actions reviewed, such corrective action shall include all affected persons.

d. The contractor will promptly investigate all complaints of alleged discrimination made to the contractor in connection with its obligations under this contract, will attempt to resolve such complaints, and will take appropriate corrective action within a reasonable time. If the investigation indicates that the discrimination may affect persons other than the complainant, such corrective action shall include such other persons. Upon completion of each investigation, the contractor will inform every complainant of all of their avenues of appeal.

6. Training and Promotion:

a. The contractor will assist in locating, qualifying, and increasing the skills of minorities and women who are

applicants for employment or current employees. Such efforts should be aimed at developing full journey level status employees in the type of trade or job classification involved.

b. Consistent with the contractor's work force requirements and as permissible under Federal and State regulations, the contractor shall make full use of training programs, i.e., apprenticeship, and on-the-job training programs for the geographical area of contract performance. In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision. The contracting agency may reserve training positions for persons who receive welfare assistance in accordance with 23 U.S.C. 140(a).

c. The contractor will advise employees and applicants for employment of available training programs and entrance requirements for each.

d. The contractor will periodically review the training and promotion potential of employees who are minorities and women and will encourage eligible employees to apply for such training and promotion.

7. Unions: If the contractor relies in whole or in part upon unions as a source of employees, the contractor will use good faith efforts to obtain the cooperation of such unions to increase opportunities for minorities and women. Actions by the contractor, either directly or through a contractor's association acting as agent, will include the procedures set forth below:

a. The contractor will use good faith efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minorities and women for membership in the unions and increasing the skills of minorities and women so that they may qualify for higher paying employment.

b. The contractor will use good faith efforts to incorporate an EEO clause into each union agreement to the end that such union will be contractually bound to refer applicants without regard to their race, color, religion, sex, national origin, age or disability.

c. The contractor is to obtain information as to the referral practices and policies of the labor union except that to the extent such information is within the exclusive possession of the labor union and such labor union refuses to furnish such information to the contractor, the contractor shall so certify to the contracting agency and shall set forth what efforts have been made to obtain such information.

d. In the event the union is unable to provide the contractor with a reasonable flow of referrals within the time limit set forth in the collective bargaining agreement, the contractor will, through independent recruitment efforts, fill the employment vacancies without regard to race, color, religion, sex, national origin, age or disability; making full efforts to obtain qualified and/or qualifiable minorities and women. The failure of a union to provide sufficient referrals (even though it is obligated to provide exclusive referrals under the terms of a collective bargaining agreement) does not relieve the contractor from the requirements of this paragraph. In the event the union referral practice prevents the contractor from meeting the obligations pursuant to Executive Order 11246, as amended, and these special provisions, such contractor shall immediately notify the contracting agency.

8. Reasonable Accommodation for Applicants / Employees with Disabilities: The contractor must be familiar

with the requirements for and comply with the Americans with Disabilities Act and all rules and regulations established there under. Employers must provide reasonable accommodation in all employment activities unless to do so would cause an undue hardship.

9. Selection of Subcontractors, Procurement of Materials and Leasing of Equipment: The contractor shall not discriminate on the grounds of race, color, religion, sex, national origin, age or disability in the selection and retention of subcontractors, including procurement of materials and leases of equipment. The contractor shall take all necessary and reasonable steps to ensure nondiscrimination in the administration of this contract.

a. The contractor shall notify all potential subcontractors and suppliers and lessors of their EEO obligations under this contract.

b. The contractor will use good faith efforts to ensure subcontractor compliance with their EEO obligations.

10. Assurance Required by 49 CFR 26.13(b):

a. The requirements of 49 CFR Part 26 and the State DOT's U.S. DOT-approved DBE program are incorporated by reference.

b. The contractor or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of DOT-assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the contracting agency deems appropriate.

11. Records and Reports: The contractor shall keep such records as necessary to document compliance with the EEO requirements. Such records shall be retained for a period of three years following the date of the final payment to the contractor for all contract work and shall be available at reasonable times and places for inspection by authorized representatives of the contracting agency and the FHWA.

a. The records kept by the contractor shall document the following:

(1) The number and work hours of minority and non-minority group members and women employed in each work classification on the project;

(2) The progress and efforts being made in cooperation with unions, when applicable, to increase employment opportunities for minorities and women; and

(3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minorities and women.

b. The contractors and subcontractors will submit an annual report to the contracting agency each July for the duration of the project, indicating the number of minority, women, and non-minority group employees currently engaged in each work classification required by the contract work. This information is to be reported on [Form FHWA-1391](#). The staffing data should represent the project work force on board in all or any part of the last payroll period preceding the end of July. If on-the-job training is being required by special provision, the contractor

will be required to collect and report training data. The employment data should reflect the work force on board during all or any part of the last payroll period preceding the end of July.

III. NONSEGREGATED FACILITIES

This provision is applicable to all Federal-aid construction contracts and to all related construction subcontracts of \$10,000 or more.

The contractor must ensure that facilities provided for employees are provided in such a manner that segregation on the basis of race, color, religion, sex, or national origin cannot result. The contractor may neither require such segregated use by written or oral policies nor tolerate such use by employee custom. The contractor's obligation extends further to ensure that its employees are not assigned to perform their services at any location, under the contractor's control, where the facilities are segregated. The term "facilities" includes waiting rooms, work areas, restaurants and other eating areas, time clocks, restrooms, washrooms, locker rooms, and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing provided for employees. The contractor shall provide separate or single-user restrooms and necessary dressing or sleeping areas to assure privacy between sexes.

IV. DAVIS-BACON AND RELATED ACT PROVISIONS

This section is applicable to all Federal-aid construction projects exceeding \$2,000 and to all related subcontracts and lower-tier subcontracts (regardless of subcontract size). The requirements apply to all projects located within the right-of-way of a roadway that is functionally classified as Federal-aid highway. This excludes roadways functionally classified as local roads or rural minor collectors, which are exempt. Contracting agencies may elect to apply these requirements to other projects.

The following provisions are from the U.S. Department of Labor regulations in 29 CFR 5.5 "Contract provisions and related matters" with minor revisions to conform to the FHWA-1273 format and FHWA program requirements.

1. Minimum wages

a. All laborers and mechanics employed or working upon the site of the work, will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions

of paragraph 1.d. of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph 1.b. of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

b.(1) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(ii) The classification is utilized in the area by the construction industry; and

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(2) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(3) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Wage and Hour Administrator for determination. The Wage and Hour Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or

will notify the contracting officer within the 30-day period that additional time is necessary.

(4) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs 1.b.(2) or 1.b.(3) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

c. Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

d. If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program. Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

2. Withholding

The contracting agency shall upon its own action or upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract, or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the contracting agency may, after written notice to the contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

3. Payrolls and basic records

a. Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-

Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

b.(1) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the contracting agency. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at <http://www.dol.gov/whd/forms/wh347instr.htm> or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the contracting agency for transmission to the State DOT, the FHWA or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the contracting agency..

(2) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(i) That the payroll for the payroll period contains the information required to be provided under §5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under §5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(ii) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(3) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph 3.b.(2) of this section.

(4) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

c. The contractor or subcontractor shall make the records required under paragraph 3.a. of this section available for inspection, copying, or transcription by authorized representatives of the contracting agency, the State DOT, the FHWA, or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the FHWA may, after written notice to the contractor, the contracting agency or the State DOT, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

4. Apprentices and trainees

a. Apprentices (programs of the USDOL).

Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice.

The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed.

Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly

rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination.

In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

b. Trainees (programs of the USDOL).

Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration.

The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration.

Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed.

In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

c. Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

d. Apprentices and Trainees (programs of the U.S. DOT).

Apprentices and trainees working under apprenticeship and skill training programs which have been certified by the Secretary of Transportation as promoting EEO in connection with Federal-aid highway construction programs are not subject to the requirements of paragraph 4 of this Section IV. The straight time hourly wage rates for apprentices and trainees under such programs will be established by the particular programs. The ratio of apprentices and trainees to journeymen shall not be greater than permitted by the terms of the particular program.

5. Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

6. Subcontracts. The contractor or subcontractor shall insert Form FHWA-1273 in any subcontracts and also require the subcontractors to include Form FHWA-1273 in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

7. Contract termination: debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

8. Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

9. Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

10. Certification of eligibility.

a. By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

b. No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

c. The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

V. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT

The following clauses apply to any Federal-aid construction contract in an amount in excess of \$100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by 29 CFR 5.5(a) or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

1. Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

2. Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (1.) of this section, the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (1.) of this section, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (1.) of this section.

3. Withholding for unpaid wages and liquidated damages. The FHWA or the contracting agency shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (2.) of this section.

4. Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (1.) through (4.) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (1.) through (4.) of this section.

VI. SUBLETTING OR ASSIGNING THE CONTRACT

This provision is applicable to all Federal-aid construction contracts on the National Highway System.

1. The contractor shall perform with its own organization contract work amounting to not less than 30 percent (or a greater percentage if specified elsewhere in the contract) of the total original contract price, excluding any specialty items designated by the contracting agency. Specialty items may be performed by subcontract and the amount of any such specialty items performed may be deducted from the total original contract price before computing the amount of work required to be performed by the contractor's own organization (23 CFR 635.116).

a. The term "perform work with its own organization" refers to workers employed or leased by the prime contractor, and equipment owned or rented by the prime contractor, with or without operators. Such term does not include employees or equipment of a subcontractor or lower tier subcontractor, agents of the prime contractor, or any other assignees. The term may include payments for the costs of hiring leased employees from an employee leasing firm meeting all relevant Federal and State regulatory requirements. Leased employees may only be included in this term if the prime contractor meets all of the following conditions:

- (1) the prime contractor maintains control over the supervision of the day-to-day activities of the leased employees;
- (2) the prime contractor remains responsible for the quality of the work of the leased employees;
- (3) the prime contractor retains all power to accept or exclude individual employees from work on the project; and
- (4) the prime contractor remains ultimately responsible for the payment of predetermined minimum wages, the submission of payrolls, statements of compliance and all other Federal regulatory requirements.

b. "Specialty Items" shall be construed to be limited to work that requires highly specialized knowledge, abilities, or equipment not ordinarily available in the type of contracting organizations qualified and expected to bid or propose on the contract as a whole and in general are to be limited to minor components of the overall contract.

2. The contract amount upon which the requirements set forth in paragraph (1) of Section VI is computed includes the cost of material and manufactured products which are to be purchased or produced by the contractor under the contract provisions.

3. The contractor shall furnish (a) a competent superintendent or supervisor who is employed by the firm, has full authority to direct performance of the work in accordance with the contract requirements, and is in charge of all construction operations (regardless of who performs the work) and (b) such other of its own organizational resources (supervision, management, and engineering services) as the contracting officer determines is necessary to assure the performance of the contract.

4. No portion of the contract shall be sublet, assigned or otherwise disposed of except with the written consent of the contracting officer, or authorized representative, and such consent when given shall not be construed to relieve the contractor of any responsibility for the fulfillment of the contract. Written consent will be given only after the contracting agency has assured that each subcontract is

evidenced in writing and that it contains all pertinent provisions and requirements of the prime contract.

5. The 30% self-performance requirement of paragraph (1) is not applicable to design-build contracts; however, contracting agencies may establish their own self-performance requirements.

VII. SAFETY: ACCIDENT PREVENTION

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

1. In the performance of this contract the contractor shall comply with all applicable Federal, State, and local laws governing safety, health, and sanitation (23 CFR 635). The contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions as it determines, or as the contracting officer may determine, to be reasonably necessary to protect the life and health of employees on the job and the safety of the public and to protect property in connection with the performance of the work covered by the contract.

2. It is a condition of this contract, and shall be made a condition of each subcontract, which the contractor enters into pursuant to this contract, that the contractor and any subcontractor shall not permit any employee, in performance of the contract, to work in surroundings or under conditions which are unsanitary, hazardous or dangerous to his/her health or safety, as determined under construction safety and health standards (29 CFR 1926) promulgated by the Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 3704).

3. Pursuant to 29 CFR 1926.3, it is a condition of this contract that the Secretary of Labor or authorized representative thereof, shall have right of entry to any site of contract performance to inspect or investigate the matter of compliance with the construction safety and health standards and to carry out the duties of the Secretary under Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C.3704).

VIII. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

In order to assure high quality and durable construction in conformity with approved plans and specifications and a high degree of reliability on statements and representations made by engineers, contractors, suppliers, and workers on Federal-aid highway projects, it is essential that all persons concerned with the project perform their functions as carefully, thoroughly, and honestly as possible. Willful falsification, distortion, or misrepresentation with respect to any facts related to the project is a violation of Federal law. To prevent any misunderstanding regarding the seriousness of these and similar acts, Form FHWA-1022 shall be posted on each Federal-aid highway project (23 CFR 635) in one or more places where it is readily available to all persons concerned with the project:

18 U.S.C. 1020 reads as follows:

"Whoever, being an officer, agent, or employee of the United States, or of any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of the material used or to be used, or the quantity or quality of the work performed or to be performed, or the cost thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction on any highway or related project submitted for approval to the Secretary of Transportation; or

Whoever knowingly makes any false statement, false representation, false report or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or

Whoever knowingly makes any false statement or false representation as to material fact in any statement, certificate, or report submitted pursuant to provisions of the Federal-aid Roads Act approved July 1, 1916, (39 Stat. 355), as amended and supplemented;

Shall be fined under this title or imprisoned not more than 5 years or both."

IX. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

By submission of this bid/proposal or the execution of this contract, or subcontract, as appropriate, the bidder, proposer, Federal-aid construction contractor, or subcontractor, as appropriate, will be deemed to have stipulated as follows:

1. That any person who is or will be utilized in the performance of this contract is not prohibited from receiving an award due to a violation of Section 508 of the Clean Water Act or Section 306 of the Clean Air Act.

2. That the contractor agrees to include or cause to be included the requirements of paragraph (1) of this Section IX in every subcontract, and further agrees to take such action as the contracting agency may direct as a means of enforcing such requirements.

X. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

This provision is applicable to all Federal-aid construction contracts, design-build contracts, subcontracts, lower-tier subcontracts, purchase orders, lease agreements, consultant contracts or any other covered transaction requiring FHWA approval or that is estimated to cost \$25,000 or more – as defined in 2 CFR Parts 180 and 1200.

1. Instructions for Certification – First Tier Participants:

a. By signing and submitting this proposal, the prospective first tier participant is providing the certification set out below.

b. The inability of a person to provide the certification set out below will not necessarily result in denial of participation in this

covered transaction. The prospective first tier participant shall submit an explanation of why it cannot provide the certification set out below. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective first tier participant to furnish a certification or an explanation shall disqualify such a person from participation in this transaction.

c. The certification in this clause is a material representation of fact upon which reliance was placed when the contracting agency determined to enter into this transaction. If it is later determined that the prospective participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the contracting agency may terminate this transaction for cause of default.

d. The prospective first tier participant shall provide immediate written notice to the contracting agency to whom this proposal is submitted if any time the prospective first tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

e. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180 and 1200. "First Tier Covered Transactions" refers to any covered transaction between a grantee or subgrantee of Federal funds and a participant (such as the prime or general contract). "Lower Tier Covered Transactions" refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). "First Tier Participant" refers to the participant who has entered into a covered transaction with a grantee or subgrantee of Federal funds (such as the prime or general contractor). "Lower Tier Participant" refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

f. The prospective first tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency entering into this transaction.

g. The prospective first tier participant further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transactions," provided by the department or contracting agency, entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the \$25,000 threshold.

h. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the Excluded Parties List System website (<https://www.epls.gov/>), which is compiled by the General Services Administration.

i. Nothing contained in the foregoing shall be construed to require the establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of the prospective participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

j. Except for transactions authorized under paragraph (f) of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default.

* * * * *

2. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion – First Tier Participants:

a. The prospective first tier participant certifies to the best of its knowledge and belief, that it and its principals:

(1) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency;

(2) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(3) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (a)(2) of this certification; and

(4) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

b. Where the prospective participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

2. Instructions for Certification - Lower Tier Participants:

(Applicable to all subcontracts, purchase orders and other lower tier transactions requiring prior FHWA approval or estimated to cost \$25,000 or more - 2 CFR Parts 180 and 1200)

a. By signing and submitting this proposal, the prospective lower tier is providing the certification set out below.

b. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department, or agency with which

this transaction originated may pursue available remedies, including suspension and/or debarment.

c. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous by reason of changed circumstances.

d. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180 and 1200. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations. "First Tier Covered Transactions" refers to any covered transaction between a grantee or subgrantee of Federal funds and a participant (such as the prime or general contract). "Lower Tier Covered Transactions" refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). "First Tier Participant" refers to the participant who has entered into a covered transaction with a grantee or subgrantee of Federal funds (such as the prime or general contractor). "Lower Tier Participant" refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

e. The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.

f. The prospective lower tier participant further agrees by submitting this proposal that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the \$25,000 threshold.

g. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the Excluded Parties List System website (<https://www.epls.gov/>), which is compiled by the General Services Administration.

h. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

i. Except for transactions authorized under paragraph e of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the

department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

* * * * *

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--Lower Tier Participants:

1. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency.

2. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

* * * * *

XI. CERTIFICATION REGARDING USE OF CONTRACT FUNDS FOR LOBBYING

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts which exceed \$100,000 (49 CFR 20).

1. The prospective participant certifies, by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

a. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

b. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

2. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

3. The prospective participant also agrees by submitting its bid or proposal that the participant shall require that the language of this certification be included in all lower tier subcontracts, which exceed \$100,000 and that all such recipients shall certify and disclose accordingly.

**ATTACHMENT A - EMPLOYMENT AND MATERIALS
PREFERENCE FOR APPALACHIAN DEVELOPMENT
HIGHWAY SYSTEM OR APPALACHIAN LOCAL ACCESS
ROAD CONTRACTS**

This provision is applicable to all Federal-aid projects funded under the Appalachian Regional Development Act of 1965.

1. During the performance of this contract, the contractor undertaking to do work which is, or reasonably may be, done as on-site work, shall give preference to qualified persons who regularly reside in the labor area as designated by the DOL wherein the contract work is situated, or the subregion, or the Appalachian counties of the State wherein the contract work is situated, except:

a. To the extent that qualified persons regularly residing in the area are not available.

b. For the reasonable needs of the contractor to employ supervisory or specially experienced personnel necessary to assure an efficient execution of the contract work.

c. For the obligation of the contractor to offer employment to present or former employees as the result of a lawful collective bargaining contract, provided that the number of nonresident persons employed under this subparagraph (1c) shall not exceed 20 percent of the total number of employees employed by the contractor on the contract work, except as provided in subparagraph (4) below.

2. The contractor shall place a job order with the State Employment Service indicating (a) the classifications of the laborers, mechanics and other employees required to perform the contract work, (b) the number of employees required in each classification, (c) the date on which the participant estimates such employees will be required, and (d) any other pertinent information required by the State Employment Service to complete the job order form. The job order may be placed with the State Employment Service in writing or by telephone. If during the course of the contract work, the information submitted by the contractor in the original job order is substantially modified, the participant shall promptly notify the State Employment Service.

3. The contractor shall give full consideration to all qualified job applicants referred to him by the State Employment Service. The contractor is not required to grant employment to any job applicants who, in his opinion, are not qualified to perform the classification of work required.

4. If, within one week following the placing of a job order by the contractor with the State Employment Service, the State Employment Service is unable to refer any qualified job applicants to the contractor, or less than the number requested, the State Employment Service will forward a certificate to the contractor indicating the unavailability of applicants. Such certificate shall be made a part of the contractor's permanent project records. Upon receipt of this certificate, the contractor may employ persons who do not normally reside in the labor area to fill positions covered by the certificate, notwithstanding the provisions of subparagraph (1c) above.

5. The provisions of 23 CFR 633.207(e) allow the contracting agency to provide a contractual preference for the use of mineral resource materials native to the Appalachian region.

6. The contractor shall include the provisions of Sections 1 through 4 of this Attachment A in every subcontract for work which is, or reasonably may be, done as on-site work.

**LOUISIANA
DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
REQUIRED CONTRACT PROVISIONS FOR
DBE/SBE PARTICIPATION IN FEDERAL AID CONSTRUCTION
CONTRACTS
(DBE/SBE NO GOAL PROJECT)**

A. AUTHORITY AND DIRECTIVE: The Code of Federal Regulations, Title 49, Part 26 (49 CFR 26) as amended and the Louisiana Department of Transportation and Development's (DOTD) Disadvantaged Business Enterprise (DBE) and Small Business Element (SBE) Programs, are hereby made a part of and incorporated by reference into this contract. Copies of these documents are available upon request, from DOTD, Compliance Programs Office, P. O. Box 94245, Baton Rouge, LA 70804-9245.

B. POLICY: It is the policy of the DOTD that it shall not discriminate on the basis of race, color, national origin, or sex in the award of any United States Department of Transportation (US DOT) financially assisted contracts or in the administration of its DBE/SBE programs or the requirements of 49 CFR Part 26. The DOTD shall take all necessary and reasonable steps under 49 CFR Parts 26 to ensure nondiscrimination in the award and administration of US DOT assisted contracts. The DBE/SBE programs, as required by 49 CFR Part 26 and as approved by US DOT, is incorporated by reference in this agreement. Implementation of this program is a legal obligation and failure to carry out its terms shall be treated as a violation of this agreement. Upon notification of failure to carry out the approved DBE/SBE programs, the US DOT may impose sanctions as provided for under 49 CFR Parts 26 and may in appropriate cases, refer the matter for enforcement under 18 U.S.C. 1001 and/or the Program Fraud Civil Remedies Act of 1986 (31 U.S.C. 3801 et seq).

C. DBE/SBE OBLIGATION: The contractor, subrecipient or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of US DOT assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the DOTD deems appropriate.

The preceding policy and DBE/SBE obligation shall apply to this contract and shall be included in the requirements of any subcontract. Failure to carry out the requirements set forth therein shall constitute a breach of contract and, after notification by DOTD, may result in termination of the contract, a deduction from the contract funds due or to become due the contractor or other such remedy as DOTD deems appropriate. The contractor is encouraged to use the services offered by banks in the community which are owned and controlled by minorities or women when feasible and beneficial.

The terms DBE/SBE are inclusive of women business enterprises (WBE) and all obligations applicable to DBE/SBE shall apply to firms certified and listed as WBE.

D. SPECIFIC CONTRACTOR REQUIREMENTS: This project has not been selected for a specific DBE/SBE goal; however, the contractor is required to meet the following obligations and by signing this bid gives the assurances that:

(1) The contractor shall not discriminate on the basis of race, color, national origin, or sex in subcontracting work on this project.

(2) The contractor shall promptly pay subcontractors and suppliers their respective subcontract amounts within 14 calendar days after the contractor receives payment from DOTD for the items of work performed by the subcontractors in accordance with Louisiana Revised Statute 9:2784. Retainage may not be withheld.

a. Delay or postponement of payment to the subcontractor may be imposed by the contractor only when there is evidence that the subcontractor has failed to pay its labor force and suppliers for materials received and used on the project. Delay or postponement must have written approval by the Project Engineer.

(3) The contractor shall submit DOTD Forms OMF-1A, Request to Sublet, and OMF-2A, Subcontractor's EEO Certification and have them approved by the DOTD prior to any subcontracting work being performed. The requirements of Subsection 108.01, Subletting of Contract, of the Project Specifications shall be met.

(4) The contractor understands that these provisions are applicable to all bidders including DBE/SBE bidders.

General Decision Number: LA150016 01/02/2015 LA16

Superseded General Decision Number: LA20140016

State: Louisiana

Construction Type: Highway

Counties: Lafourche and Terrebonne Counties in Louisiana.

HIGHWAY CONSTRUCTION PROJECTS

Note: Executive Order (EO) 13658 establishes an hourly minimum wage of \$10.10 for 2015 that applies to all contracts subject to the Davis-Bacon Act for which the solicitation is issued on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least \$10.10 (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract. The EO minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/02/2015

ENGI0406-001 10/28/2010

	Rates	Fringes
Mechanic.....	\$ 25.40	8.05

SULA2011-004 08/26/2011

	Rates	Fringes
CARPENTER, Includes Form Work....	\$ 19.13	
CEMENT MASON/CONCRETE FINISHER...	\$ 18.00	2.94
IRONWORKER, REINFORCING.....	\$ 17.49	
LABORER: Common or General.....	\$ 13.83	2.94
PILEDRIVERMAN.....	\$ 19.00	

Power equipment operators:

Asphalt Paver.....	\$ 17.20	4.97
Backhoe/Excavator/Trackhoe..	\$ 20.03	
Broom/Sweeper.....	\$ 15.17	5.15
Bulldozer.....	\$ 16.40	
Crane.....	\$ 25.97	
Grader/Blade.....	\$ 15.88	
Milling Machine.....	\$ 16.63	2.14

Roller (Asphalt and Dirt		
Compaction).....	\$ 14.74	4.23
Trencher.....	\$ 14.38	
Truck drivers:		
Dump Truck.....	\$ 12.93	0.18
Water Truck.....	\$ 13.79	

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

=====

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that no one rate prevailed for this classification in the survey and

the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal

process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

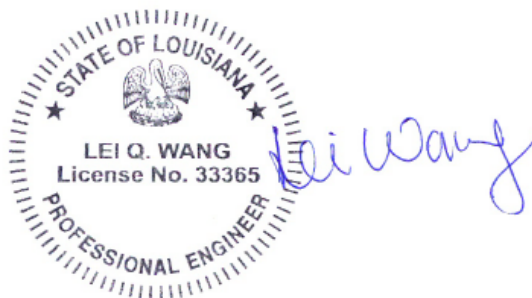
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END OF GENERAL DECISION

Louisiana
Department of Transportation
and
Development

Traffic Control Standard
Number 18A

Traffic Signal Control System



Revised March 3, 2010

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INTRODUCTION

This specification sets forth the minimum requirements for traffic signal control system which is a complete electrical device mounted in a cabinet for controlling the operation of a traffic signal. A shelf-mounted, digital, solid-state traffic controller with peripheral equipment in the controller cabinet of the type specified shall be furnished with time-based coordination, closed-loop system communication/coordination, multiple railroad/fire preemption sequences, and hardwired/telemetry interconnect capable of operating as both a master and secondary.

The signal controller unit shall be based on the requirements of NEMA Standards Publication No. TS-2, 1998. Controller sequencing referenced in this standard for diamond intersections emulates the design and standards from the Texas Department of Highways and the Texas Transportation Institute. The controller should have a database that conforms to Section 3.5 of the current NEMA NTCIP specifications. The cabinet shall be based on the requirements of NEMA Standard Publication No. TS-1 -1989. All components and accessories shall comply with the NEMA testing requirements and a Certification of Compliance shall be presented with each bid for that equipment being offered. The operational requirements herein extend the requirement of NEMA controllers and supersede NEMA where differences occur. All equipment and operational characteristics specified herein shall be provided, except where noted

Pole mounted, Actuated TS2 Controller with Type 3E cabinet (Stock #: 14-06-3596):

A signal controller assembly contains a signal controller timer unit and all other necessary peripheral equipments in type 3E cabinet for a pole mounted application.

Ground mounted, Actuated TS2 Controller with Type 6E cabinet (Stock #: 14-06-3576):

A signal controller assembly contains a signal controller timer unit and all other necessary peripheral equipments in type 6E cabinet for a ground mounted application.

TS 2 with Ethernet port, 8 Phase Signal Controller Timer Unit (Stock #: 14-06-2730):

A signal controller timer unit with an Ethernet port on the front panel with no internal communication module card unless noted on the plan.

Twisted Pair Communications Module (Stock #: 14-06-2880):

An internal twisted pair interconnect modem as specified in section 3.0.

External RS232 fiber communication module (Stock #: 14-06-2881):

An external fiber interconnect modem as specified in section 3.0.

Internal Ethernet Communications Module (Stock #: 14-06-2882):

An internal ethernet interconnect modem as specified in section 3.0.

1.0 CLOSED-LOOP COMPUTER OPERATING SYSTEM

The closed-loop central operating system shall be a traffic management program for hard-disk supported IBM personal computers and compatible equipment which creates a system network using the principle system components. The software shall operate using Microsoft's Windows operating system. The software shall be programmed resident for the operating system.

1.1 Software Description

The software shall be loaded into the specified personal computer and operationally verified by the supplier. Back-up software shall be supplied on a compact disk or digital CD.

The software shall be licensed to the agency for its use on a single computer or each computer specified in the system. Software improvements and enhancements to the supplied version shall be furnished to this agency at no additional cost. Software is supplied when indicated on the plans for a state job and will be specific to a highway district and must be compatible with existing software in place.

Programming displays, on the PC screen, shall aid the operator in entering data from the PC keyboard. These displays shall be arranged in using a tool bar format. The main tool bar shall allow the user to select a major function. A sub-tool bar shall be allowed for selection of a specific area within that function when it exists.

The central computer software shall provide rapid movement through menus, sub-menus and data base pages and limited only by the operating speed of the computer. Returning to the main menu or sub-menu shall be selected by pressing a single key.

Menus and sub-menus shall not contain mnemonics or codes for descriptions. Additional screens shall be provided where necessary to explain keyboard procedure. All icons that are defined within a tool bar shall be described in a help line as the cursor is placed over that icon.

Traffic engineering terminology shall be used throughout the programming displays. Display organization and data entry approach shall allow system operators to program the central computer without using reference cards or manuals.

1.2 Software Features

Once the computer power-up routine is complete, the system shall be in monitor mode. It shall be possible for the operator to exit this mode and enter the user mode, and vice-versa.

In monitor mode, central computer shall continue to monitor events even if the printer is off-line. Upon restoration of the printer, it shall print a hard-copy of events occurring prior to and during printer off-line.

Central computer software shall provide:

- a. Dynamic Displays
- b. System Printouts
- c. Data Base Management
- d. Security
- e. Directories
- f. Data Back-up

1.3 Dynamic Displays

Central computer shall display the following in real-time color graphics selected from the menus:

- a. Intersection Display
- b. System Map Display

All text data shall be displayed in traffic engineering terms. Mnemonics shall be acceptable; however, the need for reference guides and manuals shall not be acceptable. All information shall be simultaneously and continuously displayed until canceled by the operator. Displays shall not affect system on-street operation. The displays shall have a minimum one second resolution.

1.3.1 Intersection Display

The central computer shall display the operation of any selected intersection controller within any selected system.

Each display shall be user-created to indicate the intersection configuration, including any "T" and standard diamonds, on a single screen display. The intersection display shall show as a minimum:

- a. Intersection configuration layout for all possible phasing of intersection controllers including overlaps.
- b. All vehicle signal indications, (R,Y,G) for each active phase.
- c. All pedestrian signal indications: walk, flashing and solid don't walk, for all 16 active phases.
- d. Vehicle and pedestrian detector actuation for each displayed phase.
- e. Cycle, offset, split or plan in effect.
- f. Arterial master and intersection controller identifier numbers, including intersection street names.
- g. Central computer and local intersection controller time of day (TOD) clocks.

The display shall include dynamic statuses of the arterial master and the intersection controller. Arterial master status shall consist of operational status, cycle, offset, split, plan in effect, cycle length, cycle countdown, and status of special functions. System control mode status shall include manual, external, time-of-day, or traffic responsive operation. This status shall indicate whether the system is operating under plan, time-base coordination, or time-base backup.

Intersection controller dynamic data shall consist of operational status; non-interconnected coordination, coordination offset value, or free/plan indicator; split values based on cycle and split in effect; preemption status; and diagnostic indications. Operational status shall include on-line, off-line, failed, or disabled. If the intersection controller is off-line or failed, the conditions causing that failure shall also be displayed. All diagnostic indications having alarm status shall be shown flashing. Alarms, preempt call numbers, and preemptor in effect shall also be shown. If preempt is in a flashing operation, it shall be displayed as flashing.

1.3.2 System Map Display

System Map Display shall provide geometric layout of the system for a minimum of 32 intersections simultaneously and show real time display. The display shall also indicate the relative placements for a minimum of sixteen system detectors.

Any intersection shall be selected to present a full screen display as stated in Section 2.3.1.

A map editor shall permit the user to lay-out the intersections in their relative physical relationship to each other, place the system detectors anywhere along the approaches, and number the intersections appropriately. Five-legged intersections, central business district layouts (CBD), and angled approaches shall be possible.

A text editor shall permit the user to create a minimum of 50, 20-character strings and place them on the display. This feature shall allow labeling streets, detector identification, or other points-of-interest. All text would preferably be placed at any angle on the screen. For instance, street names shall follow the angle of the drawn street (horizontal, vertical, or diagonally), if desired.

Display data shall include current system operating parameters, special function status, cycle countdown, zone control mode of operation, and consolidated intersection status.

Consolidated intersection status shall indicate if an intersection is on-line, free, has a coordination fault, is in preemption or flash, or has a communication failure.

1.4 System Printouts

System printouts present system readiness and operational status and are used for analyzing system performance. The printouts shall be divided into four categories: Computer Events, Event Reports, Status Reports, and Logs, as detailed in this specification.

1.4.1 Computer Events

The central computer shall provide a monitor mode of operation to receive status change and operating failure event reports from any arterial master or isolated controllers.

Events shall be allowed for display on the central computer terminal or printed as a hard copy when they are received. Events shall consist of system identification, time and date of event occurrence, device identification (if device diagnostic event), and event description.

The central computer shall store events in a hard disk file to produce event reports, as needed. It shall be possible to transfer event files to a storage diskette for historical record keeping. Event files shall be removed from hard disk after file transfer to storage diskette to prevent overflowing the hard disk.

1.4.2 Event Reports

Event report capability shall be provided for events occurring on one day, or group of days, from central computer files on the hard disk or storage diskette.

A directory search capability shall be provided that lists all event files for any system by date, on the selected disk drive. If one day is selected, the date shall be entered directly or by directory search. Directory search shall be used to select dates for event reports for a group of days.

It shall be possible to display and print events as received or sorted by event type. If event type selected is for a system device, it shall be possible to specify all devices or a single device.

Menus shall be provided to facilitate event type selection. Program operation shall allow interactive operation for preparing an event report for any combination of event type and system device.

1.4.3 Status Reports

Status reports shall be generated by the arterial master controller in response to a manual command by the operator at the central computer. These reports shall present an immediate record of system operational status on the central computer display. Provision shall be made for hard copy printout.

1.4.4 Logs

Detector data shall be processed by the central computer. Real-time logs shall be printed as received by the central computer while in the monitor mode. System detector logs shall be scheduled, formatted, and sent from the arterial master.

1.5 Database Management

1.5.1 Programming Displays

A database management program shall exchange and update data with arterial master and intersection controller. Each arterial master and intersection controller shall have separate database programming pages. These pages shall contain all the programming options unique to each controller type.

Once database management is selected from the main menu, a sub-menu shall be presented listing the database pages available for programming. It shall be possible for the user to scroll through the data pages of a sub-menu or enter and exit a data page without waiting for data to fill the page. For example, page up and page down functions shall permit the operator to go from page 1 to 30, within 5 seconds.

All programming entries shall primarily consist of numerical values, YES/NO or ON/OFF entries. During program entry, the new data shall over-write the old data. If the data is in error, changes shall not be permitted and the user shall be alerted by either an error message on the display or a warning tone.

1.5.2 Upload/Download

All devices shall use upload/download techniques for database programming. The arterial master shall employ an additional database programming method through direct data entry.

Upload/download shall transfer the entire programmable database from/to the arterial master or any intersection controller via the arterial master, with the exception of intersection controller preemptor and overlap configuration.

All upload/download data shall use block transfer techniques, and shall be verified by block check-sum and word parity. Non-verified data shall cause termination of the upload/download with no data transfer taking place. It shall not be possible to load erroneous interval and configuration information to the controller.

Upload techniques shall not cause the system or intersection controller to go off-line. Traffic control operation shall remain intact in all respects.

The program shall compare the database of any arterial master or intersection controller to the database on file following an upload. The compare function shall be executed by simple keyboard technique and shall identify any differences between loaded and file data. The system operator shall be able to correct, use, or substitute data values, and proceed with further comparison.

1.5.3 Backup Database

Data from the backup files shall be read and verified for programming EEPROMs to be installed in intersection controllers and arterial masters.

1.5.4 Auto Print

Selection to automatically print any or all arterial master or intersection controller databases that are stored in the central computer shall be provided. Selection eliminating intersection controllers which are not in service when all intersection controllers are selected for printing shall be provided.

The system shall print only pages within a database that contain data. Pages with no user-entered data shall be skipped. If a database is selected for printing, but is not found on the central computer hard disk, it shall be noted on a separate sheet of the print.

1.6 Security

System security at the central computer shall be ensured through three levels of access. The levels shall be as follows:

- a. Supervisor
- b. Data change
- c. Viewer

The supervisor and data change levels shall have separate access codes that must be entered prior to making database changes.

The supervisor level shall permit access code number assignments and database changes. Data change level shall permit database changes. If an incorrect code is entered, database changes are denied. Viewer level shall not permit any database changes.

1.7 Directories

System and intersection directories shall include location of arterial masters and associated intersection controllers by name or number.

System directory text shall describe each of the systems. A system name may be entered and shall identify the system in menus, report titles, and arterial master database pages.

Intersection directory text shall list intersection names and telephone numbers for each associated arterial master. An intersection name may be entered and shall identify the intersection in menus, intersection displays, and intersection database pages.

The user shall assign names to the intersection controller alarm inputs. These names shall identify alarms in event reports. Each alarm name shall be a maximum of twenty characters.

1.8 Database Backup and Restore

The system shall include an option for making backup copies on diskettes of the database files contained in the central computer. All files required to restore the system to operation without the need to re-enter data shall be included on the backup diskette.

The central computer's files containing records of event and buffered data shall be saved on hard disk when received from the arterial master. Provision for transferring computer files to storage diskettes shall be included. After transfer to storage diskette, monitor files shall be removed from the hard disk by a user selected command. Storage diskette files shall allow for data analysis by the same report programs used for files on hard disk.

1.9 Software Maintenance Agreements

The software agreement for licensing to the Department shall be in force upon the acceptance by the vendor to supply equipment and software to the Department either by purchase order or construction project and must be compatible with the existing controllers in the field for a minimum of the last five (5) years. Minimum 6 USB security keys shall be provided. Replacement USB keys shall be made available to the Department.

1.9.1 Performance

The vendor shall warrant that the software will perform according to the specifications without end and provide free updates to be compatible with a new operating system if needed.

1.9.2 CPU Limitations

The vendor shall agree that it will be the Department's option to use the software on upgraded equipment at any time and use the software on backup equipment for a limited time. The limits of use shall be as previously stated.

1.9.3 Backup Provisions

The vendor shall agree that the Department will utilize off-site storage for the software and backup files. Copies of these files shall be made by the Department as needed within the operational guidelines previously stated.

1.9.4 Operational Restrictions

The vendor shall agree that the Department will utilize the software to monitor any system within the Department's responsibility.

1.9.5 Maintenance Standards

The vendor shall agree to supply the Department with updates to the software. If the updates require upgrading of the Department's equipment, the vendor will provide the source codes to the Department for the version of software provided to the Department.

1.9.6 Source Codes

The vendor shall deliver the source code and documentation to the Department to be used in the event of failure to provide support to the software. A viable holding arrangement will be considered as an alternate method for source code to be delivered to the Department at no cost to the Department. This option shall be stated on the order, plans, or other purchase agreements for the controllers, otherwise will not be required.

2.0 SYSTEM COMMUNICATIONS

This section specifies the minimum requirements for signal system communication functions. The controller unit shall communicate with a system master controller, central computer (for isolated intersections), or portable computer connected directly to the controller. Internal settings, including coordination, shall be accessible via an external Hayes compatible modem through the RS-232 interface. The controller unit shall receive system master commands and data transmissions. In addition, it shall transmit the controller unit status, database, and system detector information to the system master. All alarms provided shall be accessible through the RS-232 port by remote interrogation and by automatic dialing initiated by the controller unit.

2.1 System Commands

The communication shall allow the controller unit to receive, as a minimum, the following commands:

- a. The coordination pattern (selects the cycle, offset, and split)
- b. Time of day and date
- c. Special function commands (minimum of four)
- d. Free and flash mode command patterns
- e. Control of the local system on a specified master controller
- f. Request for local status

2.2 Status Data

The status of each of the following functions shall be transmitted from each controller in response to a status request from any monitoring device:

- a. Green and yellow status for all phases and overlaps
- b. Walk and pedestrian clearance status for all phases
- c. Vehicle and pedestrian detector status (8 pedestrian and 64 vehicle detectors)
- d. Phase termination status
- e. Local Cycle time
- f. Coordination status
- g. Conflict flash status
- h. Local flash status
- i. Preempt activity and calls
- j. Volume and occupancy data from a minimum of 16 system detectors
- k. Status of four user-defined alarms
- l. Zone map display data

2.3 Upload/Download

The communication shall provide the capability to upload/download the entire intersection data base to/from a monitoring personal computer. When desired, only a single screen of data can be sent and received from the intersection.

2.4 Operation

Communication shall operate from communication ports on the front of the controller. The controller unit shall communicate with a system master/secondary controller, central computer, portable computer, GPS unit and/or the conflict monitor with RS-232 serial ports accessible through DB-25S connectors. The reserve connector pin assignments shall be as follows:

Pin #	Designation
1	Frame Ground
2	Transmit Data
3	Receive Data

4	Request to Send
5	Clear to Send
6	Data Set Ready
7	Signal Ground
8	Data Carrier Detect
20	Data Terminal Ready
22	Ring Indicator

The baud rate of each port shall be keyboard selectable for any one of the following rates: 600, 1200, 2400, 4800, 9600, 14.4K, 19.2K, 28.8K, 33K, and 57.6K. The port shall be configured for an eight (8) bit word, one (1) start, one (1) stop bit and no parity.

The communication path shall use a twisted pair of wires. These may be leased lines (Type 3002, voice grade, unconditioned), radio modem, or dedicated cable.

Communication timers shall be programmable from 0 to 9.9 seconds.

The controller unit shall be programmable via keyboard with a user assigned, unique address identifying both the master and the local intersection controller. Both the master and local intersection databases shall be contained in one hardware unit.

2.5 Intra-System Communication

Intra-system communication shall be achieved through one of the four RS-232 serial ports defined herein and an external modem. The twisted pair internal modem, external fiber modem or the internal Ethernet module shall not be provided with order unless specified elsewhere.

The four RS-232 ports shall be defined as the follows:

Port 1 – System UP port for communications to the central software package and/or communications to another sub-master/local controller.

Port 2 – System DOWN port for communications to another sub-master/local controller.

Port 3 – PC/Print port for communications to a PC and/or serial device such as a GPS and/or conflict monitor.

Port 4 – Aux port for communications to the conflict monitor and/or GPS device.

2.5.1 Twisted Pair Communications Module (Stock #: 14-06-2880)

The Controller shall have the capability of containing an internal frequency shift keying (FSK) TS2 modem card that is integral to the controller and compatible with the existing field controllers and controllers in the LADOTD inventory for a minimum of the last five (5) years. A 4800 baud model and a 9600 baud model shall both be available. These items may be listed as separate line items on the bid documents and/or maybe required in the controller unit as specified by the bid documents. The modem module shall interface to the CPU board via a ribbon cable and shall contain a locking device to prevent accidental unplugging. The unit shall be easily serviceable for ease of maintenance and programming. Both the 4800 baud and 9600 baud modems shall be capable of both full and half duplex operations. An end of line option and a high sensitivity option shall be user programmable per unit.

2.5.2 External RS232 fiber communication module (Stock #: 14-06-2881)

The external fiber modem shall be shelf mount and compatible with the current approved LA DOTD signal controller. It shall be for single mode fiber. The standard connection shall be ST type with RS-232, RS-422 and RS 485 interface. The modem shall operate from -40 C to +74 C. Loss budget shall not be more than 30 dB and bit error rate shall not be more than 1 in 10⁹. Self diagnostic functions with 16 X 2 Character visual screen display are required.

2.5.3 Internal Ethernet Communications Module (Stock #: 14-06-2882)

The Controller shall have the capability of containing an internal Ethernet module that connects to the CPU board via a ribbon cable. The ribbon cable and Ethernet module shall contain a locking device to prevent accidental unplugging. The unit shall be easily serviceable for ease of maintenance and programming. The internal Ethernet module shall be an independent module that can be added to any controller on this contract. The bid documents shall state if the module is to be included with each controller unit or supplied as a separate line item on the bid.

2.5.4 GPS Interface

The controller firmware for both the On-Street Field Master and the Local controller shall be capable of polling a GPS device for time sync updates a minimum of twice per hour. One of the four (4) programmable RS232 ports provided on the front panel of the controller shall act as a direct interface to the GPS device. If required on the bid documents and / or plans and specifications, one (1) GPS kit consisting of one (1) GPS with cabinet mounting plate and interface cable shall be provided with each cabinet assembly. The GPS interface shall be compatible with the existing controllers in the field and in the inventory for the LADOTD for a minimum of the past five (5) years.

2.6 Radio System Communication (Inter-System) – (When Specified)

The data radio modem system is for microprocessor based control equipment. The modem is external to any other equipment in the controller cabinet and at the terminus and shall be provided for data transmission and indicated on the plans. The modem shall provide half or full duplex communications. The modem shall connect directly to the controller in accordance with these standards for the auto dial modem stated above.

The Department will provide the necessary management to obtain a study for interference on the above mentioned radio frequencies, coordinate the frequency to be used, and apply for licensing to use the frequency. The equipment shall operate at the assigned frequency and the supplier/contractor shall make the necessary adjustments for correct operation.

2.6.1 Radio Modem

The modem shall meet the environmental requirements of NEMA TS-2 TYPE 2 and be a maximum dimension of 4 inches high x 12 inches wide x 12 inches deep. Indicators shall be provided on the front of the modem indicating carrier detect, transmit data, and receive data. The following shall be the operating characteristic of the modem:

TABLE 18A-2
RADIO MODEM CHARACTERISTICS

FUNCTION	CHARACTERISTIC
Frequency Range:	173 MHz or 940 MHz range (Capable of: 138-174 MHz, 406-430 MHz, 450-475 MHz, 928-960 MHz).
Temperature Range:	-30° to +60° C.
Operating Voltage:	120/240 VAC
Transmission Mode:	16F3, 16F9, 15F2
Modulation: (Receive and Transmit)	FSK, Frequencies, 2100 Hz - mark, 1300 Hz - space.
RF connector:	Type N Female
Data connector:	RS-232-C, 9-pin
Sensitivity:	-107 dbm (1.0μV) for BER 1×10^{-3} over the voltage and temperature range.
Decoder type:	PLL FSK Demodulator
Carrier Attack Time:	10mS
Turn Around Time:	10mS Maximum
Power Output:	2 watts extendable to 20 watts, 100% duty cycle.
Frequency Stability:	±5 ppm on all frequencies.
Harmonic Distortion:	5 % Maximum
Compliances:	FCC Part 15, EIA RS-316B, and RS-232-C, as applicable.

2.6.2 Antenna

The antenna shall be connected to the modem by transmission cable. The antenna shall be a directional Yagi with a minimum of 9 Db gain and five elements. The mounting shall adapt to a 1-1/2 or 2 inch mount.

2.6.3 Antenna Tower

The contractor (for projects) shall provide a tower for mounting the antenna at the site as shown on the plans. The height of the tower shall be determined from the frequency coordination study. The tower shall be erected in accordance with the most

current version of AASHTO standard specifications for structural supports, highway signs, luminaires and traffic signals.

2.6.4 Central Office Radio Terminal

Additional labor shall be provided by the project contractor to install the antenna on the Department's tower, the cable from the antenna to the modem, and the necessary hardware to complete the installation as designated on the plans. The radio modem and auto-dial modem shall be installed in a single 19 inch rack mounting system or on a wall mountable shelf. Mounting equipment and hardware shall be provided by the contractor. The Department will supply one RJ-11C jack for the dial modem and the necessary 120 VAC outlet for the equipment adjacent to the installation as designated by the Department.

The installation shall include lightning protection on the incoming RF cable in accordance with good engineering practices.

2.6.5 Telephone Terminal Boards (For Information Only)

The following equipment will be installed into the existing PBX equipment for telephone lines needed to implement the system communication. All other equipment specified shall work with this equipment to complete the system's communications. This equipment will be installed in and manufactured by Rolm Telecommunication Company.

TABLE 18A-3
TELEPHONE TERMINAL EQUIPMENT

TYPE EQUIPMENT	MODEL
16-channel coder	#8551E
16-channel decoder	#8552A
8 channel line interface	#85540A

This equipment will be installed by the Department and made ready for the completion of the system.

3.0 SIGNAL CONTROLLER TIMER UNIT (Stock #: 14-06-2730)

This specifications set forth the minimum requirements for a shelf-mounted sixteen (16) phase full-actuated solid state controller unit with internal Time-Based Coordination (TBC), railroad / fire (emergency vehicle) preemption, diamond intersection operation, and closed loop master/secondary operation in a traffic signal controller assembly and cabinet assembly.

The controller unit shall meet the requirements of NEMA Standards Publication TS 2 1998 (TS 2), latest edition. Where a difference occurs, these requirements shall govern. TS 2 Type 2 interface shall be provided as standard unless specified otherwise.

3.1 General Requirements

The controller unit shall be microprocessor based with additional solid state electronics components for memory and data entry of all timing and traffic control functions described herein. The hardware provided shall meet the NEMA temperature requirements certified by an independent laboratory. A resident program shall start the controller operating when power is first applied, without a failure, providing the functionality described herein. The controller unit shall begin using each programmed data for the first occurrence of the event requiring the data and after data is loaded into memory. All units shall be capable of both master and secondary operations as described by these specifications.

The controller unit shall be shelf mountable enclosure containing electronics and hardware for processor/display, input/output interface, system communications, and power supply functions. The enclosure shall be constructed of sheet aluminum and a maximum of 15 inches wide x 10-1/2 inches high x 10 inches deep. All exterior surfaces shall be finished with a durable protective coating or anodized. Model and serial number shall be permanently attached and/or displayed on the frame of the enclosure.

The controller unit shall provide electronic circuitry to monitor the operation of the microprocessor. Processor and circuitry faults shall be detected and shall set the voltage monitor output FALSE then indicate an error message on the front panel display.

The controller unit power supply shall provide for isolation and protection against power surges, generate all regulated voltages for internal and external use, and provide power monitoring control signals. The minimum power output shall be 24 watts @ 24 VDC. Additional protection shall be designed into the power supply for radio-frequency interference filtration including a differential and common mode noise filter. Fuse protection shall be provided for the 115 VAC input and 24 VDC power output. These fuses shall be mounted on or accessible from the front of the controller without removing the panel held by fasteners requiring tools for removal.

All timing shall be referenced to the 60 Hertz input power. This reference shall control all timing of the controller unit.

A power retaining component, "super cap", shall be provided for maintaining the time-of-day clock and temporary data storage during a primary power outage. The component shall provide sufficient voltage supply for a power interruption of forty-eight hours. Lead-acid and Ni-Cad batteries are not acceptable.

3.1.1 Keyboard

The programming of the controller shall be accomplished using a keyboard and shall include vehicle, pedestrian, and preemptor calls during test. The keyboard shall be located on the front panel of the controller unit. The keyboard shall be socket mounted for easy maintenance.

The keyboard contacts shall be constructed to be environmentally sealed, highly resistive to oil, dust, water, and most harsh environments and have a minimum rated lifetime of one million operations per key. All keys shall provide positive tactile feel and/or sound to the user.

All keys shall be clearly labeled indicating their function. Numerical keys shall be arranged in a standard telephone pattern. Keys used for YES/NO or ON/OFF entries shall be appropriately labeled. Additionally, data entry control and cursor keys shall clearly indicate their function.

Cursor keys shall provide directional movement of the cursor to any data entry position desired. The cursor keys shall auto-repeat if depressed for longer than one second, to facilitate locating a data entry.

3.1.2 EEPROM Data Module

User programmed settings and intersection configuration data shall be stored in an electrically erasable programmable read only memory (EEPROM). The device shall have the ability to be reprogrammed a minimum of 1500 times. Sectional programming of the EEPROM for each data entry shall be acceptable only if the manufacture guarantees the life of the EEPROM under normal use for a period of 10 years.. Designs using a battery to maintain user data entries shall not be acceptable. Additional requirements concerning data references are found in section 8.5.

To facilitate data transfer from one controller unit to another, the EEPROM device shall be mounted on a sub-module (Data Module). The Data Module shall connect to the processor/display module via a DIN type printed circuit connector.

3.1.3 Firmware

The firmware shall be stored in a Flash ROM. The firmware (proprietary software) updates shall be accomplished by using upload/download unit connected to the controller's RS - 232 port (storage in Flash ROM). It shall not be necessary to physically replace hardware components to update the firmware. Connecting the upload/download unit to a communications port on the controller and transferring the new firmware from files on the PC and a Palm handheld device to the controller's programmable read only memory (PROM) shall accomplish the update procedure. The components shall accept a minimum of one thousand (1000) firmware updates. The following components shall be supplied to accomplish the firmware update:

1. PC and Palm handheld compatible software program to accomplish the transfer with a verification routine.
2. One (1) copy of instruction manual for the entire process.

The update process shall be accomplished at a transfer rate of ninety six hundred (9600) baud.

If the requirements of this section conflict with any provision of this specification (TCS 18A), the requirements of this section shall rule. No provision of this specification shall relieve the vendor of supplying a controller that meets the requirements.

3.1.4 Display

A liquid crystal display (LCD) shall be provided on the front panel of the controller unit to display programming and operational status information. The display shall be clearly readable in bright sunlight or dim artificial light without shading the display. The contrast of the display shall be adjustable. If after the Department's evaluation that this requirement is not met, backlighting shall be provided. It shall contain a minimum of four (4) lines with forty (40) alphanumeric characters per line. The display shall have an expected continuous life cycle of ten years while operating in the NEMA temperature range or be replaced by the supplier at no cost to the Department.

The display shall have two (2) modes of operation, dynamic and programming.

The dynamic mode shall display operational status information, while the programming mode shall display user-programmable information. The normal display shall be either blank or a dynamic display as stated below.

The dynamic displays shall provide a visual status of the real-time controller unit operations. Data entry shall be prevented without a display indicating the location for the data and the data that will be entered in this mode. Data entry during this display is acceptable only as an extra method, not as the primary data entry method. The dynamic displays shall be accessible via the front panel keyboard. The following status displays shall be specific to each of the major functions of the controller unit.

The controller timing displays shall be a dynamic display that indicates ring, phase, and coordination status information. Ring status shall include phase timing, current interval and time remaining for both rings, simultaneously. Status messages shall include current vehicle and pedestrian intervals, reasons for phase termination, and Max timer in effect.

Phase status shall indicate the current phase(s) timing and which phase(s) is next to time, vehicle/pedestrian call/recall information and preemptor calls.

The coordinator status display shall indicate the command source, current cycle/offset/split, local/system cycle count, commanded/actual offset, and offset correction. This display shall provide co-ordination relationship to phase operation in real time and be a single display.

The preemptor status display shall indicate calls, preemptor active, and delay period timing. Also indicated shall be preemptor timing, the phase(s) timing while in preemption, interval, and time remaining on the interval.

The detector status display shall indicate activity for all detectors. The display shall indicate detector calls as they are processed by the controller unit.

- Programming Displays

The programming displays shall aid the operator to enter data from the keyboard. These displays shall be arranged in a menu format. The main menu shall allow the user to select one of the major functions of the controller unit. A sub-menu is permissible to display selection of a specific area within that function. Cursor keys shall allow the user to move up, down, left, or right through the data of the menu.

Multiple data entries shall be shown at the same time to facilitate programming. It shall be possible to return to the main menu or sub-menu by a maximum of two (2) key strokes.

English language and traffic engineering terminology shall be used throughout the programming displays. Display organization and data entry method shall allow traffic engineers or technicians to program the controller unit without using reference cards or manuals. Mnemonic usage shall be minimized and limited to recognized traffic engineering terms.

All programming entries shall consist of numerical values, YES/NO, ON/OFF, TRUE/FALSE, logical 1's/0's entries. During program entry, the new data shall be displayed as it is entered from the keyboard. For quick entry of data, a repeating or copy function shall be provided. If the data is in error, the user shall be alerted by an error message on the display. Previously programmed entries shall remain until valid data is entered.

3.1.5 Programming

The programming methods shall not affect normal operation of the controller unit.

Download flexibility shall permit individual transfer of each major programmable category or the entire data base at one time.

Controller unit programming shall be accomplished by the following methods:

- a. Front panel keyboard through menu access.
- b. Downloading data from a LA DOTD computer with Windows software system (including lap-top) running the appropriate software and using the controller unit terminal interface directly or via a dial-up modem.
- c. Data module transfer from one controller unit to another as specified in firmware section.

3.1.6 Programming Security

A four digit code shall be user selected, and stored in EEPROM, for one level of programming security. Display features shall be available without the need to employ the access code. The controller unit shall be supplied with the codes preset to all zeros (0000).

If the access code has not been entered and a data entry attempt is made, then a prompt, requesting the access code, shall appear. Once entering the code, the screen shall revert to the previous display and data entry shall be permitted. The code shall not appear on the screen at any time. No further access code entries shall be required.

When the access code is required for data entry, the controller unit shall automatically set the locked access mode following a period of keyboard inactivity for eight minutes.

The access code shall be changeable only if the previous access code has been

entered. Additionally, it shall be possible to prevent changing the access code from the keyboard.

3.1.7 Memory Clear

A memory clear function from the keyboard shall not be permitted for the user to clear data entries. Default values shall be entered by the user to supersede previously programmed data.

3.1.8 Interface Connectors and Printed Circuit Boards

All interface connectors shall be accessible on the front of the controller unit and rigidly secured to the controller by the shell of the connector. Three MS-type connectors (A, B, C), meeting the pin assignment and interface requirements of the NEMA Standard shall be provided. A fourth connector, identified as the D connector shall be provided for auxiliary inputs and outputs as specified within this standard.

Four (4) RS232 ports shall be provided for communications with the system software, portable download/upload unit, conflict monitor and intra-system communications. These four (4) ports shall be keyboard-assignable for any of the communications functions. All four (4) ports shall be RS-232 serial port accessible through both DB-25 and DB-9, twenty-five pin and nine pin, subminiature, dual-inline connectors. An Ethernet port shall be provided. Additional ports required for closed loop secondary operation shall be supplied, if necessary to support the vendor's standard closed-loop application software. Each unit shall support all necessary communication ports for both master and secondary operation.

One SDLC port shall be provided per unit in compliance with NEMA TS-2, 1998 specifications.

All connectors shall be mounted a minimum 1-1/2 inches apart providing hand working room for comfortable installing and removing of the mating connectors.

All inputs and outputs to the controller unit shall conform to the applicable interface and environmental requirements of the NEMA Standard.

All printed circuit boards shall meet, as a minimum, the requirements of the NEMA Standard. In addition, they shall also meet the following requirements:

- a. All plated-through holes and circuit traces shall be plated with solder to protect exposed copper. Any wire jumpers included on circuit boards shall be placed in plated-through-holes that are specifically designed to contain them. Circuit track corrections by track cuts and jumpers that are tack soldered to circuit tracks are not acceptable.

- b. Both sides of the printed circuit board shall be covered with a solder mask material.

- c. The circuit reference designation for all components shall be clearly marked adjacent to the component. Pin 1 for all integrated circuit packages shall be designated on all printed circuit boards.

- d. All electrical mating surfaces shall be gold-flashed.

e. All ICs, 14 pin and up, shall be installed in machine tooled grade sockets meeting these requirements. All sockets shall be AUGAT-8XX-AG11D or approved equal, meet UL specification 94V-0, be constructed with two-piece, machined contacts and close-ended to eliminate solder wicking. The outer sleeve shall be brass with tin or gold plating and tapered to allow easy IC insertion. The inner contact shall be beryllium copper sub-plated with nickel and plated with gold. Surface mount components not on sockets shall not be allowed.

3.1.9 Service Equipment (to be provided when stated on order)

The controller unit design shall use printed circuit boards that plug into an internal harness array and/or connector plug within the unit. All circuit boards shall be mounted vertically. Transformers, capacitors, and transient suppressor components are exempt from the above requirement.

The controller unit design shall allow easy removal or replacement of a circuit board. All printed circuit boards shall be keyed to prevent improper installation.

The controller unit enclosure shall be constructed to allow complete disassembly using hand or standard screwdriver operated fasteners. The unit shall be designed for adequate accessibility to troubleshoot and test one side of any circuit board while the unit is still in operation. If testing cannot be accomplished with boards in their assigned position then extender boards or cables may be used. Only one board at a time shall be required to be moved during testing.

One set of cables and/or extender boards shall be provided with each order of ten controllers, two sets for twenty controllers, with a maximum of three sets of cable or extender boards.

One portable controller testing facility shall be provided with each order of ten controllers, two for twenty controllers, and a maximum of three for more than thirty controllers.

The testing facility shall provide switches for testing all NEMA inputs and LED's for all NEMA outputs. In addition, indicators and switches shall be provided for testing all the requirements within this standard except for the communication ports and/or RS-232 connectors.

The facility shall be contained within a weather proof enclosure, with quick release closure latches, and have a carrying handle. All harnesses shall be provided with the standard A, B, and C harnesses permanently wired within the enclosure. The additional harnesses shall be connected within the enclosure with a circular plastic connector meeting the requirements for type and pin assignment for the fourth connector installed in the cabinet. All standard NEMA functions shall be permanently labeled for each indication and switch. All additional inputs and outputs shall be identified with overlays which can be labeled identifying the function.

All servicing equipment shall be identified and documentation shall be provided which includes wiring diagrams and schematics.

3.2 System Master Capabilities Design Requirements

The system master shall be a microcomputer device that shall control and supervise a minimum system of twenty intersection controllers. It shall provide the communications link between the central computer and each of the intersection controllers within the system. The system master shall be assigned a unique identification number for communications on the same link with other system masters. An optional method for providing system master operation is to include the master operation as part of the software within the secondary controller. This option shall require the operation of the traffic signal control and system master without interference between them. Priority shall be given to the traffic signal control and operation as defined in this section.

Each master shall generate system commands to its associated intersection controllers, either in response to prevailing traffic conditions analyzed by system master using detectors information or by time-of-day scheduling, external command inputs, or manual inputs.

The central plans shall be constructed with the following minimum options:

- a. 48 patterns with a unique cycle length per pattern
- b. From one to four offsets per pattern
- c. Selection of one split per pattern from a table of 32 programmable splits
- d. Selection of one sequence per pattern from a table of 16 programmable sequences.
- e. Pattern 254 (NTCIP) causes the intersection to operate in free.
- f. Pattern 255 (NTCIP) causes the intersection to flash as programmed internally

The reference point for all cycles shall be programmable by the user. Normally it is initialized to midnight.

A minimum of 48 patterns will be provided. Each pattern can make all the selections as defined in Section 3.5 of the NTCIP NEMA protocol.

The system master shall monitor the operation of all the associated intersection controllers, communication paths, local detectors, and system detectors. User programmable reporting alarms shall initiate failure reports to the designated terminals from a list of user identification numbers. A minimum of four terminals shall be assignable.

System master shall provide:

- a. Traffic Plan Selection
- b. Crossing Arterial Synchronization
- c. Diagnostics
- d. Events
- e. Logs
- f. Reports
- g. Data Entry

Alternative crossing arterial synchronization shall be accomplished by using the master synchronization reference point. The operating cycles having the same cycle length will be referenced to the same point. An additional interface method shall be used to operate both

arteries on the same cycle length. Associated system control shall also be included for mutual coordination.

3.2.1 Traffic Plan Selection

The traffic plan shall be selected on a priority basis. The priority order shall begin with the highest being:

- a. Manual commands
 - b. Central System commands
 - c. Time-of-day/day-of-week/week-of-year scheduled commands
 - d. Traffic responsive commands.
- Traffic Responsive Operation

Traffic plans shall be automatically selected in response to real-time system detector input data. These commands shall be transmitted to, received and implemented by the intersection controllers within the master's system.

A minimum of 48 system detector inputs shall be provided and each, if selected, shall be processed into scaled values used for volume, density, and occupancy data. The volume and occupancy scale factors shall be user-specified and programmable through the keyboard into the master for each detector; otherwise a default value of zero shall be entered. Each detector shall be user-programmable as one of two directions or crossing direction.

Detector data shall be processed to provide a value representing traffic conditions for each function. The process shall include:

- a. Data computations resulting in values accurately representing vehicle volume (vehicle/hour), occupancy (time detected), and density (vehicle/mile).
- b. Comparison of computed values determining the relative volume and density for traffic conditions detected and assigned to directions as stated above.
- c. Accumulation of detection values over a user programmable time interval, evenly divided into a minimum of ten sampling periods, shall provide smooth transitions into selected programs designed by the Department to progress traffic through the system. Functional requirement for this process is to select a cycle, offset, and split from user specified values of detector data.
- d. User-specified adjustment factors for each function shall be used to make the detector data be within 50 to 100 percent of selected vehicle density characteristic.

Function values shall be compared to user-specified threshold values for traffic plan selection. Plan selections shall not oscillate between plans which have numerically close values. A method of hysteresis shall be used to prevent oscillation.

Ranges for six traffic volume and occupancy levels shall be programmable and used for comparing the master's computed volume and

occupancy level from the overall detector data. Level one shall be associated with light traffic with no coordination and level six shall be associated with heavy traffic. Twelve programmable thresholds shall be provided for the master's comparison values to implement plan selection based upon its computed values.

Arterial directional preference shall be determined by computing directional detector data. The magnitude of the difference and directional preference shall be compared to user programmed threshold values to select and implement directional or average offsets.

Split selection shall be based on user assigned system or phase detector data. Programmable weighing of each detector data, as stated above, shall be used by the master for computing each detector adjusted data. The master shall implement the appropriate split by comparing the main street and cross street data. Programmable values shall be used for selecting four levels of increasing values and four levels of decreasing values. If an error condition is detected, the selection shall default to average or user specified value.

Based on the master's computed detector data levels, a user-specified traffic plan shall be selected as the traffic responsive plan. If computed level or computed offset cannot be determined because of detector failures, a default plan shall be implemented from TOD plan or from TBC.

Each traffic plan contains a programmed split command for that plan. Alternately, it shall be possible to select splits and special function commands for user-specified plans based on split demand function values. Four split/special function combinations shall be available.

- Time-Of-Day/Day-Of-Week/Week-Of-Year Schedule

Time-of-day scheduling shall be controlled by an internal clock, accurate to the power line frequency. In the event of a power failure, the clock shall be maintained for a minimum of 72 hours. Leap year shall be automatically compensated for and daylight savings time shall be programmable for date of occurrence. A minimum of 24 user-defined programs shall operate on a daily, weekly, and yearly basis.

TOD programming shall follow Section 3.5 of the NEMA NTCIP specifications.

Programmable entries shall include:

- a. Day-program assignment
- b. Start time
- c. Traffic pattern (cycle, offset, split, special functions, free, plan command)
- d. Traffic responsive plan enable
- e. Traffic responsive plan override of TOD
- f. Sample period interval
- g. Sample period log interval

h. Detector log interval

The arterial master shall update time and date in all intersection controllers in a system a minimum of once every hour.

The arterial master shall include a time comparison feature. This feature shall indicate the need to update the master clock after being compared with the reference clock in the central personal computer. It would be preferred to enable a clock reset from the central computer to update the master clock with the time from the central computer.

- External Commands

External commands shall be received from a remote source such as another arterial master. These control signals shall be used to initiate an external plan. Alternatively, the external command inputs shall be used for crossing arterial synchronization. External commands shall override TOD and traffic responsive operation.

- Manual Entry

Manual entry from the front panel keyboard or a remote source shall provide the highest priority of plan selection. It shall be the default program if traffic responsive operation fails and a TOD plan is not specified.

- Pattern Mode Entry (Test Command)

Mode commands shall allow selection of any defined pattern. Intersection controllers may contain the same or different programs which shall allow sub-system coordination or independent operation under time-base control.

- Diagnostics

Diagnostic tests shall be continuous checks performed on system detector data, communications, and communication connected devices. Detected faults shall produce event failures at the arterial master and the central computer.

Failures shall be displayed on the arterial master. A fault isolation routine, selected from the front panel keyboard, shall identify the failed device. The operator shall have the ability to display all fault conditions on command.

- Power Fail Restart

Following a power interruption, the arterial master shall update the clock and bring itself on-line automatically and gain control of the system.

- Device Event Reports

If operating in a system, diagnostic failures shall be reported to the central computer as events. The following devices shall be monitored:

a. Communication

- b. Local intersection controllers
- c. System detectors
- d. Local detectors

Report events shall verify system master and local intersection controller responses. Communication tests can be a specific test or results from normal evaluation during operation and shall be as follows:

- a. System Master Test - A system master test failure shall occur when the master does not respond to central computer commands. If a response is received within three seconds following a failure, the failure condition shall automatically clear, restoring system master/computer service.
- b. Local Intersection Controller Communication Test - A local intersection controller communication failure shall occur when valid data is not received by the master for five seconds. If data is received within five seconds following a local intersection controller communication failure, the failure condition shall automatically clear, restoring local intersection controller communications.

Local intersection controller events shall indicate CMU flash, local and commanded flash, cycle fail, coordination alarm, local and commanded free, coordination error, preempt, and user-designated events:

- a. CMU flash - If intersection controller status indicates CMU flash for a period in excess of a user-programmable period of 0-30 seconds, the intersection controller shall fail and a CMU flash event shall be recorded.
- b. Local Flash - If intersection controller status indicates CMU flash is OFF and flash is not commanded from the arterial master, the intersection controller shall be considered off-line and a local flash event shall be recorded.
- c. Commanded Flash - If intersection controller status indicates flash, CMU flash is OFF, and flash is commanded from the arterial master, the intersection controller shall be considered off-line and a commanded flash event shall be recorded.
- d. Cycle Fail - If intersection controller status remains in the same phase with opposing phase calls for two cycles during coordination or three minutes if the system is free, the intersection controller shall be failed and a cycle fail event shall be recorded.
- e. Coordination Event - If intersection controller status indicates a coordination alarm condition, the intersection controller shall be failed and a coordination event condition shall be recorded.
- f. Local Free - If intersection controller status indicates a free condition and free is not commanded from the arterial master, the intersection controller shall be considered off-line and a local free event shall be recorded.
- g. Commanded Free - If intersection controller status indicates a free condition and free is commanded from the arterial master, the intersection controller shall be considered off-line and a commanded free

event shall be recorded.

h. Coordination Error - If intersection controller status indicates a coordination error condition, the intersection controller shall be considered off-line and a coordination error event shall be recorded.

i. Preempt - If intersection controller status indicates a preempt condition, the intersection controller shall be considered off-line and a preempt event shall be recorded.

j. Event 1/Event 2 - If intersection controller status indicates an event 1 or event 2 condition, the intersection controller shall feed back user-designated alarm information and an event 1 or event 2 shall be recorded.

- Detector Diagnostics

System detector diagnostics shall check for maximum presence, minimum presence, excessive counts, and no activity. If a system detector is diagnosed as failed or in error, then data supplied by that device shall be automatically eliminated from system computations.

Local detectors shall be checked for maximum presence and no activity only.

Detector diagnostics shall be performed each minute. Diagnostic periods shall vary depending on the diagnostic test.

Maximum presence events shall be generated by a continuous detector call during a user-specified diagnostic period. The diagnostic period shall be user-selected from 0-30 minutes.

Excessive count events shall be generated if a detector volume count is greater than or equal to a user-specified excessive count threshold. The diagnostic period shall be user-selected from 0-30 minutes.

No activity events shall be generated if vehicle counts are not received during a user-specified diagnostic period. The diagnostic period shall be user-selected from 0-255 minutes.

Detectors shall be failed when its operation is not within the specified criteria. A detector that begins functioning within the specified limits shall be returned to a non-failed status and its input used by the controller.

- Monitor Events

Status changes and operating failure events at any intersection controller or arterial master shall be recorded by the arterial master at the time of failure or event occurrence. Events shall be reported to the central computer on a priority basis.

Reporting priority shall be selected by event or failure. It shall be programmable as: immediate, report with higher priority, or not at all.

Two telephone number entries shall be programmable from the central computer for reporting events to central computer and for reporting device failures to another maintenance computer or terminal. Device failure reports shall be transmitted to the designated computer or terminal only when

scheduled by a TOD entry.

If the central computer is busy or off-line, a reporting arterial master shall repeatedly attempt to call at a preset retry interval in the range of 3 - 15 minutes.

Reporting shall be selected for directing all events to a central computer and maintenance computer or terminal when this capability is selected. Printed events shall consist of the following categories:

- a. Program and TOD changes
- b. System events
- c. Device diagnostics
- Program and TOD Changes

Program and mode changes shall occur automatically as a result of traffic responsive plan computations, TOD scheduling, external, and manual commands. Program and mode event changes shall include the following:

- a. In-effect program change
- b. Traffic responsive program change
- c. Special function change
- d. Time-of-day interval change
- e. Controller command TOD change
- System Events

System events shall be arterial master self diagnostics. The diagnostic messages shall include:

- a. Power-off (Comm-failure)
- b. Power-on (Comm-failure)
- c. Power interrupt
- d. Clock error
- e. Backup

Power-off event shall be stored in memory and reported when power is restored.

Power-on event shall report the time and date that power is restored. Time and date information shall be accurate if power is off less than 72 hours.

Power interrupt event shall report when power was off for less than one second.

Clock error event shall report when time and date information is different from the central computer reference. This event shall automatically occur whenever power was off greater than 72 hours. A clock error event shall inhibit TOD operation and scheduled reports until the clock has been reset and is functioning correctly.

Backup event shall indicate a data change in the arterial master memory. All memory shall be automatically re-initialized with a backup data base to allow continued operation.

- Device Diagnostics

All device diagnostic failures shall be reported as events. Refer to Section 4.3 for diagnostic descriptions.

- Real-Time Detector Logs

Real-time logs shall provide the operator with a permanent record of system detector data. Real-time logs shall consist of the following categories:

- a. System detector log
- b. Sample period log

- System Detector Log

System detector logs shall show actual volume, and occupancy for user-specified system detectors. Volume shall be the number of vehicle counts accumulated, while occupancy shall be the actual percentage of time that vehicle presence was detected during a 15-minute log period.

Detector data intervals shall be user-specified by TOD scheduling. The user shall be capable of enabling and disabling the real-time log without affecting previous entries. At the end of the interval, the arterial master reports the log to the central computer for printing. The log shall not be stored on hard disk.

- Sample Period Log

Sample period logs shall show computed parameters used in determining the traffic responsive plan selection. The sample period log interval shall be user-specified as a multiple from 1-6 sample periods by TOD scheduling.

If the default log period is programmed to be zero, the sample period log shall be reported when there is a change in the computed traffic responsive program. The user shall be capable of enabling and disabling sample period logs without affecting previous entries. The sample period log is reported to the central computer for printing. The log shall not be stored on hard disk. The sample period log shall consist of the following:

- a. Scaled volume and occupancy for enabled system detectors
- b. Scaled volume and occupancy for detector groups with assigned detectors
- c. Current value of each program selection function
- d. Smoothed value of each program selection function
- e. Computed program selection values
- f. Selected traffic responsive plan program
- g. In-effect program and cycle length

Additionally, the printout shall identify groups that have not been assigned and parameters containing errors.

3.2.2 Status Reports

Manually commanded status reports shall be provided to allow the operator at the central computer an immediate record of system operations. Reports shall consist of the following categories:

- a. System status
- b. Controller failure summary
- c. System detector failure summary
- d. Current 15-minute system detector log

- System Status

System status report shall describe the system operating conditions. The report shall be a concise printout including the following:

- a. Traffic responsive program (computed values)
- b. Traffic responsive plan
- c. Program-in-effect and source
- d. Special function status
- e. Communication status:
 1. System master communication failure
 2. Local intersection controller communication failure
- f. Intersection controller status:
 1. On-line
 2. Off-line
 3. Failed
- g. System detector status:
 1. On-line
 2. Failed
- h. Local detector status:
 1. Failed

Local detectors shall be identified by intersection controller number and assigned phase. Intersection controller off-line shall indicate a disabled intersection controller or a non-coordinated intersection controller due to the following conditions: preemption, coordination error, local free, commanded flash, or local flash.

- Intersection Controller Failure Summary

Intersection controller failure summary shall identify failed intersection controller(s) and probable cause(s). Probable failure causes shall be as follows:

- a. Communication
- b. Cycle failure
- c. CMU flash
- d. Coordination alarm

- System Detector Failure Summary

System detector failure summary shall identify failed system detector(s) and probable cause(s). The possible failure causes shall be as follows:

- a. Communication
- b. No activity
- c. Maximum presence
- d. Excessive counts

- Current Detector Log

Current detector log shall show actual volume and occupancy recorded during the last log period. Volume shall be the number of vehicle counts accumulated while occupancy shall be the actual percentage of time a vehicle presence was detected. This data shall be indicated per detector.

- Stored Events

Stored events shall be a report of the last events stored in the arterial master (up to 255). These events shall be printed in the order recorded. If the event storage memory becomes full, the newest event over-writes the oldest event.

3.2.3 Coordination/System Operation Commands

The controller unit shall provide coordination functions to control intersection cycle lengths, system offset relationships, and phase split timing. The coordinator shall perform these functions by internally manipulating the appropriate controller unit inputs. The controller unit shall be programmable for selecting these functions as output during all modes of coordination, controller unit designated as master, secondary or isolated.

Coordination functions shall be provided as a standard controller unit feature. These functions shall be included in the equipment and software provided. Hardwired inputs and outputs for coordination functions shall be through isolation relays, specified elsewhere, and shall be binaurally encoded on the respective cycle and split input lines. The voltage on the hardwired interconnect shall be 120VAC. The input lines shall have no active inputs for cycle one and split one. Cycle four and split four shall be activated by both the cycle two and three or splits two and three inputs being active respectively. Offsets one through three shall be only activated one at a time by the synchronization pulse being superimposed upon active line. The offset line shall operate by using a continuous high (120VAC) interrupted by a low for three seconds at the coordination point. Only one offset line shall be operated at a time. The remainder of the required system operations is not required to operate within a hardwired system.

Alternate methods to the cycle-split concept of coordination shall be evaluated based upon providing programmable time distribution to control vehicle movements within system parameters for traffic progression. A minimum of sixteen “programs”

of the alternate method shall be provided and controlled by the inputs specified and shall meet the requirements for coordination.

- Transition Cycles

The controller unit shall provide a smooth and orderly transition during operational changes in both free and coordinated operations. No skipping of through movement phases shall be allowed when changing a sequence from a lead-lag to a lag-lead.

- Free to Coordinated Transition

During the free to coordinated transition, the controller unit shall complete a pick-up cycle before entering the coordinated mode. The pick-up cycle shall begin upon receipt of a sync pulse and a valid coordination command. During the pick-up cycle, the coordinator shall service all non-coordinated phase calls in normal sequence until entering the coordinated phase(s).

- Coordination Command Transfer

The coordination command shall contain the system cycle, offset, and split. Command changes shall be implemented concurrent with a sync pulse. The cycle and split command shall take effect when the local zero point of the existing cycle is reached. Command transfers shall not stop the sequencing of the phases during the change except as noted elsewhere in this standard.

The coordinator shall provide five cycles. Each cycle shall have a minimum programmable cycle length from 10-255 seconds, in 1-second increments.

Coordination timing shall be synchronized to the leading edge of the system sync pulse (master zero). This point shall serve as the reference for all offset timing.

The coordinator shall check for the proper occurrence of the system sync pulse, once each cycle. If a sync pulse does not occur, the coordinator shall self-sync and continue to operate with the last set of coordination commands.

Self-synchronization shall continue for a minimum of two cycles. If a sync pulse does not occur within the self sync period, the coordinator shall revert to the non-interconnected coordination mode.

- Hardwired Interconnect

The controller shall provide for external inputs to be used for coordination. These inputs shall be connected to the wiring for the special connector described elsewhere in this standard.

The coordinator shall provide a minimum of one offset per pattern. Each offset shall be programmable within the cycle in 1-second increments from 30 to 254 seconds.

The offset shall be defined as seconds from the beginning of the master cycle counter to the beginning of the local cycle counter. When entering splits according to the NTCIP format, it shall be possible to select that the coordinated phase begins with the local zero point or ends with the local zero point. Time of day will be used to sync the master cycle counter within the local controller. The master cycle count

shall be seconds past the programmed reference, modulo of the current selected cycle length.

The coordinator shall provide offset correction through the following methods:

a. Shortway Offset Seeking

Shortway seeking shall establish an offset within the shortest number of cycles by either lengthening or shortening the cycle length. The method provided by the manufacturer shall continue sequencing the phases until the programmed offset is established and shall be limited to a maximum of four cycle lengths. Any method that causes the controller to lose coordination or force to dwell and require the coordination to begin a second re-sync routine will not be acceptable. The controller shall be cable of programming four (4) phases per pattern that cannot be shortened by this method.

Offset changes shall be accomplished by lengthening only if the reduction of the current cycle length is shorter than the sum of the controller unit's minimum vehicle interval lengths. In addition, all offset corrections shall be programmable to be lengthened only.

b. Dwell

The controller shall dwell in the coordinated phase if this method of offset seeking is selected. The sequence will begin in the first cycle after the offset is established and within the programmed permissive and force-off parameters for that cycle.

• Split

The controller unit shall provide one unique splits for each cycle which shall equal a total of 48. Each split shall have the capability of having two unique forces off points per phase for use during special coordinated operations. Each split shall provide a split interval for each phase of the controller unit. Each split interval shall be programmable in seconds within the cycle length timing in 1 second increments.

a. Split Intervals.

Split interval settings shall determine the maximum time, including vehicle clearance (yellow and red) for a non-coordinated phase, or minimum time for a coordinated phase during the cycle. These times shall be controlled by establishing a force-off point for each phase within the cycle. Force-off points shall be determined from the phase timing values and split interval settings. Force-offs shall meet NEMA requirements and continue to be applied until the phase is terminated. An optional method shall be provided to allow two unique force off points per phase that are user programmable.

b. Coordinated Phase Split Extension.

During coordination, an option shall be programmable to operate the

coordinated phase(s) as actuated or non-actuated. If the coordinated phase is actuated, vehicle detections shall permit the coordinator to extend a phase beyond the normal yield point. Extended coordinated phase green shall be selected in seconds or terminated by a force-off setting for that phase. Selection of the CNA I and/or II operation per cycle will meet the non-actuated operation with the selected phase remaining green until the programmed force-off for that phase is reached.

- Permissive Periods

Permissive periods shall be timed in seconds within the cycle length and provided for each cycle or program to control the time period when the coordinated phase is released to service calls on the non-coordinated phases.

- a. Yield Point.

The yield point shall be defined as the point within the cycle when the hold input is released on the coordinated phase and the controller unit is allowed to service calls on non-coordinated phases. A force-off point shall be applied at the time the hold is released, unless a force-off has been programmed for this phase.

The yield point shall begin from the coordinated phase split interval and pedestrian clearance plus vehicle clearance time. The coordinated phase pedestrian clearance period shall always begin at the yield point regardless of calls on the non-coordinated phases.

- b. Permissive Periods

All permissive period timing shall begin at the yield point. A minimum of three programmable permissive periods shall be provided. The vehicle portion of each permissive period shall be a programmable timed interval within the cycle length. An automatic pedestrian permissive period shall be allowed for phases following the coordinated phase(s). Each permissive period shall be programmable for selecting phases that would operate during this period. This function shall operate as follows:

- a. During the first permissive period, the controller unit shall answer only vehicle or pedestrian calls on the phase(s) following the coordinated phase in the programmed sequence. If the controller unit yields to a call during this period and the all remaining phases are allowed during this period, then other permissive periods shall be inhibited. All remaining calls shall be served in programmed sequence.

- b. The second and third permissive periods shall be programmable for beginning and ending after the yield point. During each permissive period the controller unit shall answer calls on each period's programmed phase(s).

- c. An alternate method for the permissive period operation

described above will be considered. The principle guide lines for controlling phase time shall be followed.

c. Single Permissive Period

Single permissive period shall become operational by eliminating the second and third permissive periods as described above. This single permissive period shall be similar to the first permissive period, except that the controller unit shall answer calls on any phase in order of the programmed sequence during the permissive period.

3.2.4 Cycle Programming

In addition to cycle length, offsets and splits, the following functions shall be programmable on a per cycle basis. Alternate methods of function selection shall be controlled by cycle, split, and offset inputs.

- Coordinated Phases

Coordinated phases shall be selected for each cycle. If the coordinated phase assignments are changed when transferring between cycles, the coordinator may operate in the free mode until completing a pick-up cycle.

The coordinated phases shall normally operate in the non-actuated mode during coordination. However, it shall be possible to select the coordinated phases to remain in the actuated mode.

- Phase Sequence

The controller unit shall normally use a standard quad phase sequence. The controller shall be programmable to select the phase sequence by selecting cycle and split. The phase sequencing shall be selected from the sequences specified previously. The free mode phase sequence shall be programmable from the keyboard and not restricted to be one of the coordinated sequences.

- Phase Omit

Phase omit(s) shall be selected during each cycle or program. Additionally, a phase shall be omitted if its split interval value, for the current split, is zero.

3.2.5 Crossing Artery Control

The coordinator shall be programmable for crossing artery synchronization by implementing dual coordinated phases at an intersection(s). The coordinator shall be programmable for two coordinated phases in a ring assignable to primary or secondary coordination. Phase(s) shall assigned to a secondary coordinator shall time the green of the phase until the force off occurs or shall be controlled by call to non-actuated operation.

In addition, the coordinator shall output a crossing artery sync pulse indicating

the beginning of the crossing artery phase split interval. This signal shall be used to establish the master zero for the crossing artery system master.

Dual coordination shall also force a selected crossing artery split to be used. This feature shall optimize a particular split in each cycle for dual coordination.

See Section 5.0 for alternate coordination methods and additional artery control.

3.2.6 Free

The coordinator shall provide a free mode of operation. During this mode, all coordination control shall be removed from the controller unit.

Free mode shall be selected by coordination commands, external input, or keyboard entry. Additionally, the coordinator shall revert to free mode when active controller unit inputs, or functions, would interfere with coordination. These inputs or functions shall include the following:

- a. Manual Control Enable
- b. Stop Time
- c. Automatic Flash
- d. Preemption

3.2.7 Manual Control

The controller unit shall allow entry of manual override commands from the keyboard. Manual commands shall permit individual selection of any cycle, any offset, any split or selection of the complete coordination command. When a manual cycle is selected, the sync pulse shall be generated by the time based control section of the controller unit.

3.2.8 Program Control

The alternate method of coordination shall provide manual control that shall select 1 of 16 programs.

3.2.9 Modes of Interconnect

The coordinator shall be capable of operating with any of the following interconnect types:

- a. Internal Time Based Coordination
- b. Telemetry
- c. Hardwired
- d. IP addressable

The non-interconnected coordination mode shall also serve as a backup mode to communication or hardwired interconnect.

The coordinator shall be compatible with electromechanical pre-timed interconnect which provides the sync pulse superimposed on the offset lines.

3.2.10 Master Coordinator

The coordinator shall output the coordination commands, including sync. This feature shall permit the controller unit to be used as a time-of-day master in a hardwired electromechanical pre-timed interconnected system. This feature shall be included in all controllers and shall not have restricted use.

3.3 Time-Based Control/Non-Interconnected Coordination

The controller unit shall include time based control. This capability shall be a standard feature and shall include the additional modules and/or software.

3.3.1 Clock/Calendar

The controller unit shall provide a time-of-day (TOD)/99 year clock. The clock shall be programmed for current time (hour, minute, and second), date (month, day, and year), day of week, and week of year. This clock shall be used for all time based control functions.

- Clock Accuracy

The TOD clock shall use the power line frequency as a time base. When power is removed, the time shall be maintained by a crystal oscillator.

The oscillator shall maintain the time to within + 0.005%, as compared to the Universal Mean Coordinated Time Standard. This accuracy shall be maintained over the NEMA Standard temperature range regardless of the number or rate of power failures.

The controller unit shall maintain the TOD clock during power outages for a minimum of 48 hours.

- Time and Date Entry

Time and date information shall be entered in the controller unit through the following methods:

- a. The controller unit keyboard
- b. Computer via RS-232 port
- c. Updated via system communications

- Leap Year and Daylight Savings Time

The TOD clock shall automatically compensate for leap year changes. Daylight savings time changes shall be programmable to occur on a selected week or be omitted if not programmed.

3.3.2 Time Based Control

- Program Format

Time based control shall utilize a yearly program format. The program shall select from a minimum of 60 programs with cycle, offset, and split operations assignable to a day, days of the week, weekend or any one of, selection of more than one or all 52 weeks in the year.

- Holidays

There shall be a minimum of 35 holiday or exception-day programs. Each holiday-program shall be assignable to occur on a specific month and day. Holiday-programs shall override the current day-program.

Each holiday-program shall be selected to repeat the following year.

- Program Selection

Each program shall permit selection of the following functions:

- a. Day program assignment, (Month/Week/Day)
- b. Start time, (Hour/Min/Sec)
- c. Program, (Cycle/Offset/Split)
- d. Control of a minimum of four Special Function outputs
- e. Flash
- f. Max 1 or 2
- g. Free
- h. Phase sequence

The cycle/offset/split/sequence or free commands, selected by a program step, shall serve as the coordination program only when the controller unit is operating as a TOD master or operating with time based coordination.

Remaining program step functions shall take effect immediately when the program step becomes active.

- Manual Program Selection

It shall be possible to manually force any of the program steps to override the current program step. The forced step shall be entered from the keyboard and shall remain in effect until removed or until the next programmed step.

3.3.3 Non-Interconnected Coordination

- Re-sync Time

When operating in the non-interconnected coordination mode, a programmable synchronization time shall be used as the beginning time for all cycles. All cycles shall be reset to zero, each day, at this time.

- Synchronization Point

The synchronization point will be calculated as defined in the NTCIP standard. Computing this point was described in the coordination section. Computing the synchronization point based on event changes or similar methods will not be accepted.

3.4 Local Capability Design Requirements

The controller unit shall provide the actuated control functions and operations required by Sections 2, 13 and 14 of the NEMA Standard. In addition, it shall provide the features described in the following paragraphs.

3.4.1 Phase Sequence

The phase sequence of the controller unit shall be programmable in any combination of sixteen phases to achieve phase reversal individually or by pairs, one to four independent or concurrent timing rings, multiple rings allowing selection of four-phase operated as a concurrent group, or coordination of two rings and one sequential ring divided by one barrier. Sequencing shall be selected by cycle program or timing plan. Selection of the required sequences shall be programmable from any of the following:

- a. Full NEMA and NTCIP operation
- b. Select a program number for an established phase sequence
- c. Select one to four timing rings, with concurrent or sequential phase assignment
- d. Select three or four phase diamond

Specific sequences required by the Department shall be selected from the above operation. Program for selecting phases shall include provisions to disable phases with each program, (phase on - off). Alternate sequences may be used to satisfy the above requirements however mutual coordination of the separate rings will be required. All controller units shall provide these sequences.

Diamond sequences shall include two operational sequences for interstate ramp interchanges. The operation of the controller unit as a 4 phase, and 3 phase diamond shall be keyboard selected and the standard timing function required by NEMA TS1 shall be provided for each phase. The configuration shall operate as two independent four phase rings. There shall be two mutually exclusive inputs as defined in Appendix (pins 12 and 13) that will force the controller unit into 3 phase or 4 phase operation. Additional circuits in this harness shall be for controller and cabinet interlock. Pin 35 listed in Appendix shall be a ground true controller interlock output. The controller shall assert this output when it is present and powered on. Pin 42 listed in Appendix shall be a ground true cabinet interlock input. This input shall be internally pulled up to 24VDC and the controller shall sense this input and operate only when it is present. Special clearance intervals shall be pre-

timed programmable and shall be activated within the sequence shown. This shall be overridden while under computer control, TBC control, or by the inputs defined below. Figure 18A-4 illustrates the assignment of phase numbers to the traffic movements. The additional detector inputs shall be provided with these controllers as stated in the pin assignment for the connector.

- Four Phase Diamond Operation

The normal sequence of operation shall be phase 2/5 → 4/5 → 1/6 → 1/8.

The point at which operation may be switched from 4 phase to 3 phase operation shall occur by forcing the sequence into concurrent left turns (inside clearance during Ø1 and Ø5).

The loop detector layout for 4 phase diamond operation shall be as defined in Figure 18A-5. Each detector input shall be to the phase shown and provide the normal phase timing required by NEMA TS1. The controller unit software shall provide the additional logic for Detector Circuit operation in the following description:

a. Detector Circuit #1 -

1. Shall extend phase 1/6 if phase 1/8 is called.
2. Shall call phase 2/5 if phase B overlap is not green and phase 4/5 is not called.
3. Extend intervals inside left turn clearance interval.

b. Detector Circuit #2 -

1. Shall extend phase 2/5 if phase 4/5 is called.
2. Shall call phase 1/6 if phase A overlap is not green and phase 1/8 is not called.
3. Extend intervals inside left turn clearance interval.

c. Detector Circuit #3 (45P) and #4 (45S) -

During the phase 4/5 red condition the 45P detector shall always be active and the phase 45S detector shall always be inactive. A phase 4/5 green plus a phase 1/6 call plus a 0.2 second gap in 45P detection shall disable the 45P detector and enable the 45S detector until the phase 4/5 signal changes to yellow. The circuits then switch back to normal - 18P active and 18S inactive until the condition is repeated.

d. Detector Circuits #5 (18P) and #6 (18S) -

During the phase 1/8 red condition the 18P detector shall always be active and the phase 18S detector shall always be inactive. A phase 1/8 green plus a phase 2/5 call plus a 0.2 second gap in 18P detection shall disable the 18P detector and enable the 18S detector until the phase 1/8 signal changes to yellow. The circuits then switch back to normal - 18P active and 18S inactive until the condition is repeated.

e. Detector Circuits #7 (25S) and #8 (16S) -

The phase 2/5 detector circuit shall always be active during phase 2/5 red. A phase 25 green plus a 0.2 second gap in detector 25S shall disable this circuit until loss of phase 2/5 green.

The phase 1/6 detector circuit shall always be active during phase 1/6

red. A phase 1/6 green plus a 0.2 second gap in detector 16S shall disable this circuit until loss of phase 1/6 green.

The 0.2 second gaps mentioned above shall be keyboard programmable from 0 to 3.0 seconds in 0.10 second increments or smaller.

The phase 45P detector shall always extend phase 4 during phase 4/6 interval.

The phase 45P detector shall always extend phase 8 during phase 8/2 interval.

An indication shall be provided for both the 45P detector circuit and the 18P detector circuit to indicate when they are active. When a circuit becomes inactive, the indication shall go out and stay out until it again becomes active.

f. Concurrent Timing Requirements -

Refer to Figures 18A-3 for the following descriptions.

The clearance interval phase 4/6 when sequencing from phase 4/5 to 1/6 shall time concurrently with phase 6, however phase 6 may not terminate green until phase 4 yellow interval has timed out.

The clearance interval phase 2/8 when sequencing from phase 1/8 to phase 2/5 shall time concurrently with phase 2, however phase 2 may not terminate green until phase 8 yellow interval has timed out.

All left to right internal clearance (Ø1/ Ø5) times from phase 4/5 to phase 1/8 shall use the same timing settings for minimum green, extension, max green, yellow clearance, and red clearance.

All right to left internal clearance (Ø5/ Ø1) times from phase 1/8 to phase 4/5 shall use the same timing settings for minimum green, extension, max green, yellow clearance, and red clearance.

Separate timing settings for minimum green, extension, max green, yellow clearance and red clearance shall be provided for each of the two external clearance intervals (Ø2/ Ø8 and Ø4/ Ø6 from Ø1/ Ø8 to Ø2/ Ø5 and Ø4/ Ø5 to Ø1/ Ø6).

- Three Phase Diamond Operation

- a. Sequence

The controller unit shall be keyboard selected for 3 phase diamond operation. The normal sequence of operation shall be, except as modified below, 4/8 → 2/6 → 1/5.

The point at which operation may be switched from 3 phase to 4 phase operation shall be from phase 1/5 to 4 phase inside clearance interval phase 1/5.

The path from 4/8 to 2/6 shall be keyboard selected and selected by the TBC (on a time of day basis) for one of the five possible phase combinations of lead/lag left turn clearance movements. These possible phase combinations shall be permitted when individual phase gap time expires.

4/8 → 4/6 → 2/6

4/8 → 4/5 → 2/6
4/8 → 2/6
4/8 → 2/8 → 2/6
4/8 → 1/8 → 2/6

The path from 2/6 to 1/5 shall be keyboard selected and selected by the TBC (on a time of day basis) for either 2/6 → 1/6 → 1/5 or 2/6 → 2/5 → 1/5.

The path from 2/6 to 4/8 shall always be through 1/5 and terminated simultaneously. The sequencing shall be flexible and phases shall be terminated bases on traffic actuation and gaps programmed for the phase.

b. Detector Operation

The loop detector layout for 3 phase diamond operation shall be as defined in Figure 18A-6. The 1P detector shall function as a phase 2 calling detector during phase 4 and as a phase 1 extending detector during phase 2.

The 5P detector shall function as a phase 6 calling detector during phase 8 and as a phase 5 extending detector during phase 5.

3.4.2 Timing Intervals – All Sequences

The controller shall be programmable for the following timing parameters and any of the selected sequences. Each phase shall be timed independently and special clearance phasing described in the diamond sequence may be timed by group.

The following timed intervals shall be programmable in the minimum range for each interval: Guaranteed minimum time shall be provided for each phase, overlap, and preempt yellow. Minimum values shall not be changeable or overridden from the programming sources listed in this specification. Guaranteed minimum interval value shall be three seconds. Maximum Green Intervals.

The controller unit shall provide two maximum green intervals per phase, however three are preferable. Maximum intervals shall be selected by either time-of-day or external input.

TABLE 18A-4 TIMING INTERVALS

INTERVAL	RANGE (SEC.)	INCREMENT (SEC.)
Vehicle passage	0-25.5	0.1
Yellow clearance	3-25.5	0.1
Red clearance	0-25.5	0.1
Added initial min. green	0-25.5	0.1
Red revert	0-25.5	0.1
Minimum gap	0-25.5	0.1
Delay/extend detector timing	0-25.5	0.1
Walk	0-255	1.0
Pedestrian clearance	0-255	1.0
Time before gap reduction	0-255	1.0
Time to reduce gap	0-255	1.0
Min initial green	0-255	1.0
Maximum added initial green	0-255	1.0
Overlap timing	0-25.5	0.1
Maximum green I, II & III	0-255	1.0
Maximum green extension interval	0-255	1.0

3.4.3 Maximum Green Extension

The controller unit shall be capable of extending a phase maximum green time by continuous vehicle demand. If the phase terminates by expiration of the maximum time for one successive cycle, then its maximum green time in effect (Max 1 or Max 2) shall automatically be extended by a maximum green extension interval. The maximum green time shall be increased, until it equals Max 3, on each successive cycle that the phase green is terminated by the Max 1 or 2. If the phase gaps out for one successive cycle, then the maximum green time shall return to the original Max 1 or 2 value.

An alternate method for providing active traffic responsive timing shall use the volume/occupancy system detectors capability assignment to the phase detector. A preprogrammed cycle plan shall be initiated for providing timing modification to meet the traffic demand.

3.4.4 Volume Density Intervals

Each phase shall have volume density intervals conforming to NEMA standards.

3.5 Overlaps

The controller unit shall provide sixteen internally generated overlaps: Each overlap may be programmable as standard or protected/permissive. The capability shall be provided for reassignments of a minimum of four phase outputs to overlap operation shall be in the software for implementing special sequencing requirements and shall not require rewiring the controller signal outputs on the back-panel.

3.5.1 Overlap Timing

Green, yellow and red timing intervals shall be provided for each overlap. These intervals shall permit the overlap to remain green after terminating the parent phase in addition to providing separate yellow and red clearance intervals for the overlap. A programmable feature shall provide a selection of sequencing that would hold all phases red or advance to the next serviceable phase green after the parent phase has terminated and the overlap timing is in effect. In either selection the next serviceable phase interval shall not begin timing until the overlap times have expired.

Overlaps shall be controlled by the parent phase if the overlap timing intervals are not programmed. The overlap sequence shall never violate the conventional green, yellow, red sequence under any circumstance. This timing operation shall be provided during all operational requirement herein specified. Any conflicting operation with this timing requirement shall supersede the timing extensions.

Overlap programming flexibility shall permit the user to assign the timed overlap to follow any parent phase(s).

3.5.2 Multi-Overlap Operation

The controller unit shall be capable of eight overlaps including the standard four and assigning four phase outputs as overlaps. If a phase output is assigned as an overlap then it shall function as a standard overlap and programmed in the EEPROM. Changing these overlap assignments shall be programmed from the keyboard of the controller unit and provide warning of the impending sequence change.

3.5.3 Recall Functions

The controller unit shall provide the following programmable features for each phase.

- a. Locking/Non-locking detector memory
- b. Vehicle recall
- c. Pedestrian recall

- d. Maximum recall
- e. Soft recall - Locking/Non-locking memory

Soft recall shall return the controller unit to the programmed phases in the absence of all other calls.

3.5.4 Initialization

The controller unit shall permit power start and external start to be individually programmed by phase and interval. Start intervals shall be green, yellow, red, all red or flash. During a power start condition, the controller unit shall be programmable for a timed display of an all red or flash interval before the selected start phase(s) and intervals are displayed. Data reference shall be made to the data in the EEPROM. An error shall keep the controller non-operational until the error is corrected. Resets shall be initiated to correct data integrity and begin the controller operating.

3.5.5 Last Car Passage

The controller unit shall provide guaranteed passage operation on a per phase basis. When selected, this feature shall provide a full passage (vehicle extension) interval when a phase gaps out with a gap in effect less than the passage time. The phase shall terminate after the passage interval expires.

3.5.6 Dual Entry

The controller unit shall provide both single and dual entry operation. When selected, dual entry shall cause the controller unit to insure that one program selected phase is timing in each ring. If calls do not exist in a ring when a barrier is crossed, the controller shall select a programmed compatible phase and operate it concurrently with the phase or phases that have calls. When the selected controller sequence is non-NEMA, then an acceptable method of calling a compatible phase is the use of vehicle detector switching.

3.5.7 Conditional Service

The controller unit shall provide a programmable conditional service feature when the controller is operated in the standard NEMA sequence. When selected, the controller unit shall service only one odd numbered phase during a sequence, once normal service to that phase has been completed and enough time for additional service exists on the concurrent even phase. The odd phase (left turn) shall be serviced if the vehicle clearance time of the terminating even phase plus a conditional service minimum green is less than or equal to the time remaining on the maximum green timer of the even phase which is still timing.

A conditional service, minimum green time shall be programmable for each phase. This interval shall insure a minimum green if the phase is conditionally served.

The controller shall be programmable to re-service the even phase after conditionally serving an odd phase following the same guidelines stated above. Once an even phase has been conditionally re-served, the odd phase shall not be conditionally served again until returning to the concurrent group that is timing.

3.5.8 Pedestrian Functions

The controller unit shall provide the following additional pedestrian functions:

- a. Actuated phase rest in walk
- b. Pedestrian clearance protection during manual control
- c. Exclusive pedestrian occurring once at a programmable point within each of the previously required sequences

3.5.9 Backup Protection

Programming shall be provided to inhibit re-service of odd phases within the same concurrent group. When programmed, backup protection shall take priority before conditional service.

3.5.10 Simultaneous Gap Termination

The controller unit shall provide a programmable simultaneous gap termination feature. When programmed, phases in both rings must gap out together in order to terminate the green interval and cross the barrier.

3.6 Detector Input Functions

3.6.1 Design Requirements

The controller unit shall provide a minimum of sixteen vehicle detector inputs. Each input shall be assignable to any single phase or group of phases and be programmable for type of function (detector switching).

Detectors 1 through 8 shall meet the NEMA standards for vehicle detector inputs into phases 1 through 8. Remaining detectors shall utilize inputs assigned to the auxiliary functions in the D connector as specified in the appendix.

3.6.2 Detector Input Programming

All vehicle detector input shall be user-programmable for vehicle calls to any or all of the eight phases in the controller. Each shall be selected for multiple applications identified in the following descriptions in addition to the vehicle call inputs. The controller shall include a minimum of three programming plans selected by TOD or cycle/split/offset for assignment of the programmable feature of each detector input.

3.6.3 Standard Detector Input

All inputs shall default to standard operation, providing one call per actuation and shall be assigned to each phase, (i.e. det 1 to phase 1, det 2 to phase 2, etc.).

3.6.4 Delay and Extend Detector Input Timing

A minimum of sixty-four (64) detector inputs shall be programmable to delay a vehicle call to the assigned phase(s). The delay timer shall have a range from 0 to 25.5 seconds. The timing shall begin upon activation of the input to the controller. If the input remains when the time has expired then the input shall be directed to the phase(s). The timing shall be reset when the input is removed. The delay timing function shall be inhibited during the selected phase green interval.

A minimum of sixty-four detector inputs shall be programmable for extending the vehicle call to the assigned phase. The extend timer shall have a range from 0 to 25.5 seconds. The extending time shall begin upon removal of the input to the controller and will extend the call to the phase until the expiration of the programmed time.

3.6.5 Phase Extending Detector Input

All inputs shall be programmable to extend assigned phase or phases green interval timing and once programmed this input will not call the phase for service. All input shall be programmable to switch assigned phases during a programmed red interval and begin extending the assigned phase green interval.

3.6.6 Call Detector Programming

All inputs shall be programmable to call assigned phase or phases during its red interval and not extend the green time from any actuation.

3.7 Preemption

The controller unit shall provide a minimum of five priority/non-priority preemption sequences. This capability shall be a standard controller unit feature and shall be provided within the modules and software. All required features specified above shall be available and programmable within the preemption operation.

3.7.1 Priority/Non-Priority Preemptor Design Requirements

Each of the five priority/non-priority preemptor shall be capable of railroad, fire lane, or emergency vehicle preemption sequences. Any one of the following conditions shall be selected to occur during preemption.

- a. Hold phase green
- b. Limited phase service, following track clearance
- c. All red

d. Flash

- Preemptor Call Priority

Preemptor shall be selected as priority or non-priority. Lowest numbered priority preemptor shall have highest priority and will override a higher numbered priority preemptor calls. A minimum of two preemption phases shall be give equal priority and override higher numbered preempts. Additionally, priority preemptor calls shall override all non-priority preemptor calls. Non-priority preemptor calls shall be serviced in the order received.

- Preemptor Call Memory

Each preemptor shall provide a programmable locking memory feature for preemptor calls. The preemptor in the non-locking mode shall not service a call when it is received and dropped during the delay time.

3.7.2 Priority/Non-Priority Preemptor Timing

The following preemptor timing features shall be provided for each of the priority/non-priority preemptor inputs.

- Preemptor Timing Intervals

All preemptor timing intervals shall be programmable from 0-60 minutes in 1 minute increments, 0-255 seconds in 1-second increments, or 0-25.5 seconds in 0.1-second increments, as indicated for each of the following.

- Delay Time

The delay time interval shall inhibit the start of the preemption sequence for a specified duration. This interval shall begin timing immediately after receiving a preemption call. (0-255 sec., 1 sec increments)

- Duration Time

Each preemptor shall provide a programmable minimum and maximum duration time that a preemptor shall be active, (Min: 0-255 sec., 1 sec. increments, Max: 0-60 mins, 1 min. increments).

- Minimum Times

Phase timing at the beginning of a preemption sequence shall be controlled by the programmable minimum times before advancing to the next sequential interval. Preemptor minimum times shall be programmable for the following intervals:

- a. Green / Pedestrian Clearance (0-255 sec., 1 sec. increments)
- b. Yellow (3-25.5 sec, 0.1 sec. increments)
- c. Red (0-25.5 sec. 0.1 sec. increments)

- Pedestrian Timing

If a phase is timing a walk interval at the beginning of a preemption sequence, then the phase shall advance immediately to the preemption pedestrian clearance. A selectable timing interval shall be provided to time the minimum pedestrian clearance through the vehicular yellow interval, or alternately advance immediately to vehicular yellow.

During preemption, pedestrian indicators shall be user selected to be solid don't walk, blank, or operational during preemption.

- Overlap Timing

Overlaps shall be programmed to operate with the phase(s) or to clear to red then remain red during preemption. Overlaps terminating or forced to terminate when a preemption sequence begins, shall be selectable to time the preemptor minimum yellow and red clearance times or to time programmed overlap timing specified in Section 8.3.

- Track Clearance

Each preemptor sequence shall provide user-programmable green, yellow and red track clearance intervals. Track clearance shall begin timing immediately after the preemptor minimum red interval, (Section 10.2.4).

A minimum of two (2) phases shall be selected as track clearance phases. During the track clearance period, the selected phases shall time the track clearance green, yellow and red intervals once, and then advance to the next programmed interval (Section 10.2.8).

If track clearance phases are not selected, the track clearance intervals shall be omitted from the preemption sequence.

- Limited Sequence

The limited sequence program shall be user selected and begin immediately after track clearance. It shall remain in effect until preemptor duration time, phase minimum times has elapsed, or preemptor call has been removed.

- Limited Sequence Phases

Any active phase, except a track clearance phase(s), shall be selected for operating during limited sequence operation. Those phases not selected shall remain red during preemption. The controller unit shall remain in all red interval during the limited sequence interval when no phases are selected for operation during limited sequence.

If flash is selected for the limited sequence interval, up to two permissive phases shall be selected to flash yellow. The remaining phases shall flash red. Overlaps associated with the phases flashing yellow shall also flash yellow unless they have been forced to terminate in which case they shall remain dark. Flashing shall occur by controlling the appropriate load switch driver outputs.

- Limited Sequence Timing

During the limited sequence interval, the selected phase(s) shall operate normally (as outside of preemption). When preemption is exited, the current phase shall terminate after minimum green time is expired.

If any limited sequence intervals are programmed with zero timing, the equivalent interval time of the controller unit shall be used.

- Exit Phases

Two permissive exit phases shall be selected to time after the preemption sequence has been completed. These phases shall serve as transition phases to return the controller unit to normal operation. Exit phases shall time their normal programmed interval times.

Additionally, it shall be possible to program exit calls on any of the phases used in normal operation. Phases programmed as exit phases shall be served first, while exit calls on the remaining phases shall be served in normal sequence.

3.7.3 Preemptor Active Output

A preemptor active output shall be provided for the five priority/non-priority preemptor. The output shall be set to ON when the preemption sequence begins and shall remain ON for the duration of the sequence.

3.7.4 Power Interruption

If a preemptor call is active when power is restored to a controller unit, the voltage monitor output shall be set to FALSE, placing the intersection into the flashing mode of operation. Additionally, if external start is applied during a preemption sequence, the intersection shall be placed into the flashing mode of operation. The flashing mode of operation shall remain in effect until the preemptor call has been removed or the preemptor maximum duration time has elapsed. The controller shall begin operating as described by NEMA during power interruption.

3.7.5 Preemptor Stop Time

A stop time input shall stop the timing of the current active preemptor. The stop time input shall normally be controlled by the conflict monitor unit.

3.8 Automatic Flash

The controller unit shall provide automatic flash selection per the requirements of the Manual on Uniform Traffic Control Devices. The flash phases shall be programmable through the keyboard and flashing shall be controlled by changing the controller outputs to the load switches from the normal sequencing of three outputs to a flashing output to one selected output. The controller shall be programmable for selecting the indication which will flash. Automatic flash shall be selected by external input, system command, or time-of-day from the

internal time base clock. Two flashing controls shall be provided that alternate and shall be program selected for assignment as needed to each phase that will prevent a yellow/yellow conflict.

4.0 CONFLICT MONITOR

The conflict monitor shall conform to NEMA TS-1, Section 6, in addition to the requirements of this specification. A twelve (12) channel monitor shall be provided with the controller as required on the order or plans. The conflict monitor shall be compatible with the communications requirements for the current approved controllers. Each conflict monitor shall utilize and be provided with a programming card specified in the above mentioned NEMA standards.

4.1 Mechanical Design

The frame shall be completely enclosed within sheet aluminum housing with a durable protective finish. The housing shall be removable for service to the internal circuitry.

The programming card shall be inserted through the front panel of the conflict monitor. Card guides should be provided for aligning the edge connector of the card with the mating jack. The cards shall be removable without use of tools or disassembling of the housing.

All printed circuit boards shall meet, as a minimum, the requirements of the NEMA Standard. In addition, they shall also meet the following requirements:

a. All plated-through holes and circuit traces shall be plated with solder to protect exposed copper. Any wire jumpers included on circuit boards shall be placed in plated-through-holes that are specifically designed to contain them. Circuit track corrections by track cuts and jumpers that are tack soldered to circuit tracks are not acceptable.

b. Both sides of the printed circuit board shall be covered with a solder mask material.

c. The circuit reference designation for all components shall be clearly marked adjacent to the component. Pin 1 for all integrated circuit packages shall be designated on all printed circuit boards.

d. All electrical mating surfaces shall be gold-flashed.

e. All ICs 14 pin and up shall be installed in machine tooled grade sockets meeting these requirements. All sockets shall be AUGAT-8XX-AG11D or approved equal, meet UL specification 94V-0, be constructed with two-piece, machined contacts and close-ended to eliminate solder wicking. The outer sleeve shall be brass with tin or gold plating and tapered to allow easy IC insertion. The inner contact shall be beryllium copper sub-plated with nickel and plated with gold.

4.2 Electrical Design

Liquid crystal displays shall be provided for displaying load switch outputs during

normal operation, operations selected from a menu, and fault sensed. When a fault is detected, the display shall present two displays, sequentially, one showing all load switch outputs at the time of the fault detection, and one showing the specific fault and date/time detected.

Circuitry shall be provided to detect sequential failure and indicate the channel on which the failure occurred. This feature shall be programmable to select either enable or disable for each channel. The following shall be failure indicated as sequential failures:

- a. Yellow indication on for less than 2.5 seconds.
- b. No yellow indication after green.
- c. Simultaneous display of two or more indications within the same signal head, except as allowed by the MUTCD.
- d. Combinations of any above.

All solid state components shall be mounted on printed circuit boards. The electronic components and printed circuit board(s) shall comply with the requirements outlined for the controller in Section 7.10 of this standard.

The conflict monitor shall be capable of recording and holding in memory (logs) the last ten conflicts detected and the last ten power failures. The time and date shall be indicated for each conflict and power failure. The memory shall be non-volatile during power loss and meet the requirements for the controller in Section 7.3, excluding Section 7.3.1. A log of the sequence of 20 events prior to a fault detection shall be retrievable prior to resetting the monitor and accessible through the communication port.

Each conflict monitor will be supplied with a 4-foot RS-232 cable with male connectors on each end. The monitor shall have a 9 pin communication port on the front of the monitor.

The communication port shall be as defined herein, compatible with EIA-RS-232 standards for connection to a portable computer, printer, or other electronic devices. Communications shall be full or half duplex using FSK transmissions. The data transmission rate shall be selected baud. Control of the port shall be selected in menu form on the monitor display or request through the communication port. Data transfer to other electronic devices shall be provided with download commands from the device.

The monitor display shall present a selection menu for various data and programs available. This shall include, but not limited to, date and time set, review of programmed permissive phases and various logs.

4.3 Communication

The conflict monitor shall generate a report to the controller each time a change in status occurs. The report shall include the following as a minimum:

- a) The configuration of the programming card.
- b) The channels which have the NEMA plus features enabled.
- c) A listing of the phases which are monitored for short yellow times.

Additionally, the conflict monitor shall store and report at least five (5) failures containing the information listed above when interrogated directly via the portable download/upload unit.

The report shall list at least the last five (5) failures from the monitor which contain the following:

- a) Time of the occurrence of the failure.
- b) The channels (Green, Yellow, Red and Walk) active at the time of the failures.
- c) The status of the CVM input and the +24 V 1 and 2 inputs.
- d) The type of failure (conflict, switch failure, red failure, etc.)

The conflict monitor will be capable of transmitting (via RS-232 port) an ASCII report to the controller unit.

The conflict monitor shall provide three (3) reports for interrogation. The first is an ASCII record of all data entries and programming card configurations. The second is an ASCII formatted record of all failures and each power on/off cycle. The last ten of these failure records will be available in report form. The third report will be a sampling report and will contain the twenty (20) samples of all of the inputs to the conflict monitor. Each sample will be taken at 0.1 second intervals so that the last two (2) seconds of real-time outputs of the load switches can be viewed.

Each of the reports will have the appropriate headings and will consist of ASCII lines of not greater than eighty (80) characters so that a clear presentation of the data can be viewed from the screen of a notebook computer using the standard ASCII character codes.

The monitor port shall be programmed in the following format:

- a) Standard EIA-232 convention
- b) Each word shall be eleven (11) bits long: eight (8) data bits, one (1) start bit, one (1) stop bit, no parity.
- c) 2400 to 9600 baud
- d) The note book or traffic controller unit will send a message of one byte to the monitor requesting each of the reports. After the one-byte message, the controller will issue an XON command to start the data flow. The data flow can be stopped with an XOFF command at any time.

The data sent to the notebook or controller unit in response to the request message will be the ASCII report requested. The last byte sent by the monitor will be an EOT (End Of Text- 04H).

If the controller issues an XOFF during a reporting request, the monitor will stop the data flow. If an XON is not issued within 30 seconds, the monitor will time out and set its pointer to the beginning of the report.

The next XON will then start at the beginning of the requested report. A report will also perform the XOFF function to the conflict monitor.

Definitions of the requests are as follows:

- Request report 1: 31H
- Request report 2: 32H

Request report 3:	33H
XON (DC1)	11H
XOFF (DC3):	13H

5.0 SOLID STATE SIGNAL LOAD SWITCHES

The load switches shall follow those standards previously set forth. In addition to those, each load switch shall have indicators on the front showing the input state of operation with the indicators vertically aligned and the red input on top, yellow in the middle, and green below.

6.0 SIGNAL FLASH TRANSFER RELAY

The transfer relays shall be electro-mechanical and shall be energized during normal sequential operation of the traffic signals with the operational switch in the normal position. This relay shall be de-energized when the indications are to be flashing. The relay shall transfer the field signal circuits to the flashing circuits and energize the flasher.

6.1 Physical Design

The relay shall be enclosed in a transparent case for protection against dust, dirt and other foreign objects. The case shall be a maximum of 2.671 inches high, 2.375 inches wide and 1.75 inches deep. The insulated base shall extend 0.625 inch from the case and shall be 1.990 inches wide and 1.120 inches deep. The contacts of the plug shall be flat blades arranged in two (2) parallel rows, 0.475 inch apart with the flat side of the blades in line with the row. The contacts of the plug shall be 0.250 inch wide, 0.060 inch thick, and extend past the insulated base 0.520 inch. Each row shall have four (4) contacts. The base shall be keyed with a pin that has a diameter of 0.156 inch and extend past the insulated base 0.685 inch. The pin shall be centered between the row of contacts and centered in line with contacts 5 and 6 of the plug. The contacts of the plug shall be numbered for wiring purposes, from 1 through 8. The top row shall be consecutively numbered from left to right using the odd numbers and the bottom row shall be consecutively numbered from left to right using even numbers.

6.2 Electrical Design

The relay coil shall be rigidly supported by the insulated base. The contacts shall be 2 Form C, rated at 20 Amps, and shall be 3/8 inch diameter, silver cadmium-oxide. The relay's life shall be 5 million mechanical operations and 100,000 electrical operations. Each contact shall be rated for power bus control and 1 KW tungsten at 120 VAC. The coil shall be 110 VAC and shall pick up at 80% of nominal voltage. Maximum power requirement of the coil shall be 10 VA. The relay shall be wired and the socket pin assignments arranged according to the following table:

TABLE 18A-5
TRANSFER RELAY WIRING

PIN	FUNCTION	PIN	FUNCTION
1	Relay Coil	5	Common Circuit #1
2	Relay Coil	6	Common Circuit #2
3	NC Circuit #1	7	NO Circuit #1
4	NC Circuit #2	8	NO Circuit #2

The base, relay, and enclosure shall have a minimum rating of 1500 volts.

7.0 SOLID STATE FLASHER

The flasher shall comply with NEMA TS-1, Section 8 and Section 7.2.3.2. The flasher shall be a two circuit flasher rated at 15 amps per circuit. (Type 3).

8.0 VEHICLE AND PEDESTRIAN DETECTORS

Vehicle detectors shall be fully digital, microprocessor designed, auto-tune, card rack mounted and have four channels of detection per card, Type 8. Unless otherwise noted the detectors shall be provided with the order for cabinet assembly. Detector units shall conform to applicable environmental, functional, dimensional, and design required in NEMA TS 1, Section 15. The amplifier shall not consume more than 385 ma of current at the rated voltage. Delay and extension timings shall meet this standard when the order or plans require the detector to have such timing. Each channel shall have an erasable, write-on surface for channel identification.

Pedestrian detectors shall be of an approved model accepted by the Department under the appropriate Traffic Control Standard. Each order or plans shall identify the type and quantity of detectors in each cabinet.

8.1 Sensitivity and Accuracy

Detector units shall conform to NEMA TS1, Section 15. Each detector shall be accurate for detecting all vehicles from motorcycles to tractor-trailer combinations which ordinarily travel public streets and highways and are comprised of sufficient conductive material, suitably located to permit recognition and response by the detector system. There shall be a minimum of sixteen selected sensitivity ranges located on the front of the unit for each channel. The range of sensitivity shall be, nominally, between 0.00 % - 1.250% change in total loop inductance.

8.2 Operation Modes

Each channel shall be self-tuning in accordance with the NEMA standards. Response time for compensation from extended detection, re-tuning to track the changing electrical

characteristics of the loop and recovery from power interruption shall be accomplished within 50 milliseconds. Each channel shall have an on and off switch. Each detector card shall have a momentary push switch to reset all channels.

8.3 Fail Safe

The detector shall operate when sensor loop shorted to ground or not in good condition. The unit shall generate a continuous call when re-tuning failed sensor loop or failed detector unit.

8.4 Control Voltage

All controls shall be DC voltage in accordance with the NEMA standards. The control circuit from the delay/extension feature shall follow this requirement.

8.5 Control Switches

All switches, connectors, and fuses shall be located on the front of the card. Each switch shall be permanently labeled to identify its function. Each position shall be labeled to identify its mode of operation. Each mode of operation shall be simple to program with one switch position assigned to one function.

8.6 Printed Circuit Board Design

The PC board shall be in accordance with NEMA TS1 Section 15. All pressure contracts shall be gold flashed. All components mounted and soldered to the PC board shall be easily removed and replaced without causing damage to the board or traces. Each individual PC board shall be identified by manufacturer and a serial number or part number clearly stamped or etched on the board. All PC boards shall be coated with an epoxy or approved equal type material to prevent erratic performance due to high humidity, condensation and growth of fungus and mildew. This coating will not cover the component on the board, but once the components are in place, they and the soldered joints shall be covered with a moisture and fungus proof, clear type of acrylic lacquer. This coating shall not be injurious to the board or components and shall not interfere with the repair of the circuitry or the replacement of components.

8.7 Pedestrian Detector Isolation

Two - two channel pedestrian isolation circuit boards shall be provided. There shall be two circuits using optical and transformer isolation designed and tested for a minimum of 2500 volts D.C. between the inputs and outputs. Each circuit shall recognize a minimum 5 millisecond switch closure between conductor pairs from the pedestrian push button operated on a maximum of 5 volts and 20 milliamps. Transient protection shall be on the input and shall withstand a 10 microfarad capacitor charged to 2,000 volts to be discharged between input pins or between input pin and chassis ground. When the input switch closure occurs,

the circuitry shall close the pedestrian call circuit between the controller input and logic ground and remain closed for a minimum of 100 milliseconds or the time the pedestrian push button is closed, whichever is larger. Additional circuits shall be provided to maintain isolation, lock the pedestrian actuation, and reset when an input from the DC level from the controller activates the walk and raises the potential of the field circuit from five volts to 24 volts. Each board shall have a fused power supply. Output status indicators shall be located on the front panel for each channel. A three position switch shall be provided on the front of the unit for each input circuit and provide "on", "off", and momentary "on". Alternate designs will be reviewed at the time of bid for pedestrian actuation and annunciator located at the pedestrian push button.

The card shall fit into the vehicle detector card rack. The dimension characteristics shall follow the Type 7 card detectors standards Section 15 in NEMA TS1 1989.

8.8 Pedestrian Isolation Card Connector

The isolation card shall be designed with an edge connector. The connector shall be 22 position, dual inline type connector with the following position assignments:

TABLE 18A-6
PEDESTRIAN ISOLATION CARD CONNECTOR ASSIGNMENT

PIN	FUNCTION	PIN	FUNCTION
2A/1	SPARE/CH 1 ØWALK	N	AC(+) 120 V
B/2	SPARE/CH 2 ØWALK	P	SPARE
C	SPARE	R	SPARE
D	INPUT #1	S	SPARE
E	INPUT COMMON	T	SPARE
F	OUTPUT #1 (COLLECTOR)	U	SPARE
H	OUTPUT #1 (EMITTER)	V	SPARE
J	INPUT #2	W	OUTPUT #2 (COLLECTOR)
K	INPUT COMMON	X	OUTPUT #2 (EMITTER)
L	CHASSIS GROUND	Y	SPARE
M	AC (-) 120 V	Z	SPARE

8.9 Detector Card Rack

Detector card racks shall be designed to fit top and bottom card guides for four-four channel detector cards. Two-two channel isolation cards, a power supply and two-four

channel detector cards shall be installed in type 6E cabinets.

The housing shall be constructed of 5052 aluminum alloy of a minimum thickness 0.062 inch with a protective coating (painted or anodized). Removable covers shall be provided on top, bottom, and back allowing access to the internal hardware and circuitry. Each cover shall be easily removable with the use of conventional hand tools.

The dimension of the rack in Type 3E cabinet shall be approximately 10 inches wide, 6 inches high and 9 inches deep and in Type 6E cabinet shall be approximately 14 inches wide, 6 inches high and 9 inches deep. The rack shall be mounted on the inside of the door of Type 3E cabinets as shown in drawing 18A-1 and attached to the bottom shelf in Type 6E cabinet, hinged to swing out to provide access to the rear assembly without removing the shelf(s).

The card rack for Type 3E cabinets shall be as above except: the top shall be rain proof with a drip edge to prevent water from running across the lower side of the top and into the rack and shall have a power supply, two - four channel detector cards positions, and two - two channel isolation cards. These shall be wired as follows: first card detector to vehicle call input 1 through 4, second card detector to special detector inputs 1 through 4, first isolator card to pedestrian detector inputs phases 2 and 4, and second isolator to preemptions 1 and 2. The power supply shall meet the dimensional requirement of a four channel card rack detector type 8, operate on 120 VAC, 60 Hz, and the AC+ into the power supply shall be fused. The fuse shall be located on the supply card, permanently labeled indicating the fuse and size. The supply shall meet NEMA specifications and provide 24 VDC, 385 ma, regulated as specified in NEMA TS-2-1998, Section 15.2.6.2. A power indicator and a fuse shall be provided on the front of the supply for each output. A pull handle shall be on the front of the unit. The power supply shall be located on the left side of the rack when viewed from the front. DC voltage from the power supply shall not be supplied to the isolator positions.

The rack shall be wired with a separate power cord and individual wires to each card position. The power cord shall have each wire identified with a sleeve marked, DR-AC+, DR-AC-, and DR-Gr, and terminated with a spade terminal connected to the terminal for the controller power. Each module slot shall be wired directly to the card edge connector with color coded harness. The harness shall meet the requirements for wiring elsewhere in this standard. Each detector lead in from the field wiring shall be a twisted pair. A sufficient amount of slack in the wiring harness shall allow the rack to be moved for visual inspection and mechanical repairs. The wiring shall be cabled together into a harness, attached to the back right side (viewed from the front) with an approved cable clamp, and routed to the back and detector panel.

The cards in the rack shall be numbered from left to right viewed from the front in order to identify the position function. For Type 6E cabinets, the first position will be the power supply; the second, a four channel detector for phases 1, 2, 3, and 4; the third, a four channel detector for phases 5, 6, 7, and 8; the fourth, a four channel detector for special detectors 1, 2, 3, and 4; the fifth, a four channel detector for special detectors 5, 6, 7, and 8; and the sixth and seventh, each two channel isolation card for pedestrian detection to phase 2, 4, 6, and 8 respectively. For Types 3E cabinets, the first position will be the power supply; the second, a four channel detector for phases 1, 2, 3, and 4; the third position, a four channel detector for special detectors 1, 2, 3, and 4; the fourth and fifth position each a two channel isolation card for pedestrian detection to phase 2 and 4, and preemption input to 1 and 2.

Wiring from each detector and isolator output shall be directly to and terminated to the front of the back panel at their associated terminals of the controller. The control circuit wiring for each detector and isolator input shall be made directly from the associated terminals of the controller. The wiring for the field input to the card rack shall be terminated with the associated terminal on the detector panel. Each wire from the card rack to the back panel shall be terminated using a spade type compression terminal and an identification sleeve identifying each as follows: Detector position one, VD-1-1, VD-1-2, VD-1-3, and VD-1-4; the input to these card positions shall be identified as: VD-1-1G, VD-1-2G, VD-1-3G, and VD-1-4G. The remainder of the detector wiring shall be identified in a similar manner. The pedestrian detector isolator cards outputs shall be identified as: Isolator position nine: PD-1-1 and PD-1-2, the inputs: PD-1-1W and PD-1-2W. The other isolator shall be identified similarly using PD-2-, etc.

9.0 MECHANICAL CONSTRUCTION OF ENCLOSURES (Also in TCS 36)

Cabinets shall be designed for NEMA TS1 operation and the following specifications.

9.1 General requirements

The cabinet shall be constructed of sheet or cast aluminum alloy. The sheet aluminum alloy shall be ASTM No. 5052-H32 or equivalent, and shall have a minimum sheet material thickness of approximately 1/8 inch.

The cast aluminum alloy shall be ASTM No. 356-75 or equivalent. Flat cast surfaces exceeding 12 inches in both directions shall be a minimum of 1/4 inch (0.25 inches) in thickness. Flat cast surfaces not exceeding 12 inches in both dimensions shall be a minimum 3/16 inch (0.1875 inches) in thickness.

Outline dimensions shall be as shown in Table 18A-7. All dimensions are outside of cabinet and in inches exclusive of hinges, handles, overhang(s), vent housing and adapters. Cabinet heights are measured to the lowest point of the top surface of the cabinet. The combined overhangs of the top of the cabinet shall not exceed 4 inches.

Unpainted aluminum cabinets shall be fabricated from mill finished material and shall be cleaned with appropriate methods that will remove oil film, weld black, mill ink marks and render the surface clean, bright, smooth and non-sticky to the touch.

TABLE 18A-7
CABINET DIMENSIONS

CABINET TYPE	WIDTH	HEIGHT	DEPTH
3E (14-06-3596)	22 (-0 + 15%)	55 (-0 + 10%)	15 (-0 + 15%)
6E (14-06-3576)	44 (-0 + 10%)	68 (-0 + 15%)	24 (-0 + 15%)

9.2 Cabinet construction and testing requirements

Cabinets shall be manufactured to prevent the accumulation of water on its top surface and slope in a manner to drain water to the back side of the cabinet. The highest point of the top surface shall be limited to a maximum of six (6) inches added to the overall height of the cabinet.

9.2.1 Shelves

Cabinets shall be provided with a minimum of two shelves in Type 3E, and three shelves for Type 6E to support control equipment. Type 3E cabinet shall have provisions for positioning the shelf between 10 inches from the bottom and within 8 inches from the top. Type 6E cabinet shall have provisions for positioning shelves between 24 inches of the bottom of the cabinet and to within 8 inches of the top of the cabinet in increments of not more than 2 inches. The adjustment of the shelves shall be accomplished by using small hand tools. Rivets are not acceptable. All shelves shall have a raised back edge to stop equipment from passing the back edge of the shelf. This edge shall be a minimum of ½ inch from the rear wall of the cabinet and be constructed from one continuous piece of metal.

All cabinets shall have a 1-1/2 inch drawer, mounted directly beneath the lowest shelf. This drawer shall have a hinged top cover and shall be capable of storing documents and miscellaneous equipment. The drawer shall open and close smoothly. Drawer dimensions shall make maximum use of the available depth offered by the cabinet and controller shelf, and shall have approximately the same width as the corresponding back panel. The bottom of the drawer shall have drain holes sufficient to drain any amount of accumulated water in the drawer.

9.2.2 Doors

- **Main Cabinet Door**

Cabinets shall have a single hinged main door which permits access to all equipment within the cabinet and visual inspection of all indicators and controls. Unless otherwise specified, the door shall be hinged on the right side of the cabinet as viewed from the outside facing the cabinet door opening. Type 4 cabinets shall have two main doors equally dividing the height of the cabinet front with clearances at top, middle, and bottom.

- **Hinges**

All cabinet doors shall incorporate suitable hinges utilizing stainless steel hinge pins. Hinges shall be protected to prevent being removed or dismantled when cabinet door is closed. Attachment to the cabinet shall produce a smooth finish, protruding fasteners are not acceptable.

- Door Stop

Each cabinet shall be provided with a door stop which holds the door open at positions of $90^{\circ} \pm 10^{\circ}$ and $170^{\circ} \pm 10^{\circ}$. A means shall be provided to minimize accidental release of the door stop. Type 7 cabinets shall have the door stop located at the bottom of the door and all other cabinets shall have the stop located at the top of the door.

- Locking Mechanism

All cabinets shall incorporate a main door lock constructed of nonferrous or stainless steel materials, which shall operate with a traffic industry conventional #2 key. A minimum of one key shall be included with each main cabinet door lock.

A three - point lock on the strike edge of the door shall be provided with all types of cabinets except when specified to be different on the order or plans. The three (3) points of the lock shall be located at the top, bottom, and middle of the strike edge of the door. The lock shall prevent operation of the mechanism when in the locked position.

The door handle shall rotate inward from the locked position so that the handle does not extend beyond the perimeter of the door at any time. The operation of the handle shall not interfere with the key, police door or any other cabinet mechanism or projection. The handle shall have the mechanical strength to operate the mechanism and shall be made from non-corrosive material.

Cabinets with three-point lock shall be provided with a means of externally padlocking the mechanism. A minimum 3/8 inch diameter lock shackle shall be accommodated. The lock shaft shall be 5/8 inches in diameter.

- Door Opening

The main door opening of all cabinets shall open on and be centered within the front side having the width dimensions listed in the previous table and shall be at least 69% of the area of the side. Necessary clearances shall be provided allowing unrestricted movement of the door from closed position to open position. The door shall seal against a minimum of one inch wide neoprene sponge gasket with tight seams. The top gasket shall be the width of the door, the side gaskets shall begin below the top gasket and the bottom gasket shall be within the side gaskets. A gasket retaining ring shall be installed on the inside of the gasket.

9.2.3 Cabinet Structural Tests (mounting shall withstand the following):

- Hinges and Door

The hinge and door assembly shall be of sufficient strength to withstand a load of 30-pound-per-vertical-foot of door height. This load shall be applied vertically to the outer edge of the door when it is opened to the 90 degree position. There shall be no permanent deformation or impairment of the door, locking mechanism, or door seal function after the load is removed. A stiffener shall be installed the width and at mid height of the door. The door panel shall be flat after fabrication.

- Door Stop

Both the door and door stop mechanisms shall be of sufficient strength to withstand a simulated wind load of 5 pounds per square foot of door area applied independently to the inside and outside surfaces without failure, permanent deformation, or any major movement of the door positions. For test purposes, a test load shall be applied to the vertical midpoint of the outer edge of the door at a right angle to the plane of the door. The test load shall equal one half of the calculated wind load. The force shall be applied first on the inside edge, then on the outside edge. These tests shall be performed with the door at 90degree and 170 degree positions.

- Lock

The door handle and associated cabinet locking mechanism shall withstand a torque of 100-foot lbs. applied in a plane parallel with the door to the handle in the locked position. The door handle and the external padlock mechanism shall meet the same requirement without the internal locking mechanism securing the handle.

- Shelves and Drawer

Shelves shall support a load equivalent to 2 pounds per inch of length without deforming more than 1%. The test load shall be applied at two points, 6 inches to each side of the shelf's center, with the shelf installed in the cabinet. The drawer shall support up to 50 pounds in weight when fully extended.

- Equipment Protection

Cabinets are intended to provide protection for the housed equipment. Prying open or dismantling the doors, walls, or tops, shall be prevented with the cabinet securely closed.

When completely and properly installed, cabinets shall have provision for rain water drainage. The cabinet shall not permit water to enter the equipment cavity above any live part, insulation, or wiring.

- Rain Test

All cabinets shall be designed to meet the requirements of the following tests. To insure realistic testing, the enclosure and enclosed equipment shall be mounted as intended for use.

A continuous water spray, using as many nozzles as required, shall be applied against the entire top and all exposed sides of the enclosure for 10 minutes at a minimum rate of 18 inches per hour of equivalent rain at an operating pressure of 4 to 5 pounds per square inch. The distance of the nozzles to the cabinet shall be a minimum of 36 inches and a maximum of 48 inches and located above the top edge of the cabinet.

The enclosure is considered to have met the requirement of this test if there is no significant accumulation of water within the enclosure and no water is visible on the live parts, insulation materials, or mechanism parts.

A rain test which is performed in accordance with Underwriters Laboratories, Inc., "Rain Tests of Electrical Equipment, Bulletin of Research #23, September, 1941", is considered to be equivalent to this test.

9.3 Cabinet construction and testing requirements Police Compartment

A hinged police compartment door shall be mounted on the outside of the main cabinet door. The door shall permit access to a police panel compartment for operation of switches defined elsewhere in these standards. The compartment shall be constructed to restrict access to exposed electrical terminals or other equipment within the cabinet. The door shall seal against a neoprene sponge gasket in the same manner as stated above for the main door.

Space shall be allowed for the switch controls and storing of the manual control cord in the police panel compartment with the door closed. The minimum internal dimensions shall be 3-1/2 inches high, 6-3/4 inches wide and 2 inches deep. Additionally, the volume shall be not less than seventy (70) cubic inches.

Police doors shall be equipped with a lock which can be operated by a police key, Corbin Type Blank 04266, or equivalent. A minimum of one key shall be included for the police compartment of each cabinet.

The police compartment shall be located above the bottom of the main door as shown in the following table:

TABLE 18A-8
POLICE COMPARTMENT LOCATION

CABINET TYPE	LOCATION
3E	2.5" \pm 10% from bottom and left of center, see Drawing #18A-1
6E	39" \pm 10%

9.4 Cabinet Mounting

9.4.1 Pole Mounted Cabinets, Type 3E

The cabinets shall be provided with provisions to attach a pole bracket to a reinforcement plate permanently mounted to the back, top, and center of the cabinet. The reinforcement to the cabinet shall be designed to support the weight of the cabinet and the equipment intended to be contained within and the structural loads referred to in this specification. The minimum width of the adapter shall be six (6) inches wide and three (3) inches high, tolerance of both -0 inch, +6 inches. Two 3/8 inch holes shall be drilled through the cabinet, within the reinforced area, 2 inches from center line of the width of the cabinet. Countersink each hole on the outside of the cabinet for flat head screws. Install two 5/16" flathead screws in the mounting holes with the top of the screw heads to be flush with the surface of the cabinet wall.

The cabinet shall be pre-drilled for two (2), 3 inch wire entrance holes, one in the top and one in the bottom, both at the back edge and centered on the width of the cabinet and one (1) 2 inch entrance hole adjacent to the 3-inch hole on the bottom as shown in the attached drawing. Three hubs shall be provided with Types 2 and 3 cabinets. The hubs shall be centered on the entrance holes and attached to the cabinet using four (4) 5/16 inch-18-tpi by 1-1/2 inch long hex head bolts, with lock washers and hex nuts. The hubs and cabinet shall be pre-drilled for mounting the hubs to the cabinet with the above mentioned bolts using a bolt pattern of 2-1/8 inches centered on a line perpendicular to the back of the cabinet, by 3-3/4 inches parallel to the back of the cabinet. The centers of the bolt pattern on the hub and the wire entrance hole shall coincide. The location of the hubs shall allow minimum clearance for box end wrenches to fit onto the nuts within the cabinet.

9.4.2 Pedestal mounted cabinets, Type 3E

When specified on the order or plans the requirement for a pedestal mounted cabinet shall meet the following requirements. The specified cabinet shall be provided and equipped with a reinforced bottom, 1/4" aluminum plate, and a slip fit adapter for attachment to a standard 4-inch inside diameter pipe. The bottom of the cabinet shall be provided with an access hole for cable (min. 4 inches) and mounting holes for the adapter located in the center of the bottom. The adapter shall be bolted to the cabinet with 5/8" bolts and fitted on a 6-1/2" bolt circle. The attachment to the standard 4-inch pipe shall be secured with four (4) square headed set screws. The holes drilled for pole mounting hardware and wiring shall be covered with gaskets and blank hubs.

9.4.3 Base mounted cabinets, Type 6E

The anchors bolt shall mount in each corner of the cabinet and shall be approximately located in a rectangular pattern of 18 1/2 inches by 40 5/8 inches.

Anchor bolts for base mounted cabinets shall be 3/4 inch diameter and 16

inches long. A 90° bend with a 2-inch leg on one end and a minimum of 3 inches with a UNC-10 thread shall be provided. Anchor bolts shall be steel with hot dipped galvanized finish. Each anchor bolt shall be furnished with one (1) $\frac{3}{4}$ inch UNC-10 HDG steel nut and one (1) $\frac{3}{4}$ inch HDG flat steel washer. Four (4) anchor bolts shall be provided with each Type 6E cabinet.

10.0 AUXILIARY EQUIPMENT

10.1 Fan and cooling system

All cabinets shall be equipped with a cooling system of sufficient capability to pass the test described in NEMA TS1-2.2.04. The fan shall be capable of operating continuously for a minimum of 6000 hours in a 122°F (50°C) environment without need for after-installation maintenance and deliver 100 CFM in free air. The fan shall be thermostatically controlled by switching the 120 VAC supply to the fan. The thermostat shall be field adjustable to switch on and off at any temperature between 70° and 160°F.

The exhaust shall be vented through the upper portion of the cabinet. All ventilation shall be rain-tight and shall prevent any water from dripping into the cabinet.

The cooling system shall be constructed to allow cleaning of the vents, screens and fan. Fasteners for removing panels to gain access to perform the above requirement of cleaning shall be removable with the use of simple hand tools, except as noted in Section 11.2.

An additional duplex receptacle (for use with communications modems) shall be mounted and wired in the upper left side of the cabinet assembly. This receptacle shall be wired on the load side of the 20 amp circuit breaker.

10.2 Air Filter

The cabinet shall be equipped with a secured, replaceable filter for the incoming ventilation air. The air filter shall be removable without the use of tools. The filter size shall be: 7-1/2 inches high x 7 inches wide x 1 inch deep for the Type 3E cabinets, and 14 inches high x 25 inches wide x 1 inch deep for Type 6E cabinets. The filter shall have clearly indicated on it the size and direction of air flow. A metal grid shall be on both sides of the filter. The filter shall meet ASHRAE standard 52-76 for disposable, Type II, glass fiber air filters. The air resistance shall be 0.08 inch WC, measured on 24 inches x 24 inches sample at 300 FPM. The efficiency of the filter shall be a minimum of 75 percent.

10.3 Cabinet Light

A fluorescent bulb and fixture shall be installed in cabinet Types 3E. The fixture shall be mounted against the cabinet top and the strike edge for the door. The fixture shall not extend beyond the strike edge at the top of the cabinet and shall not restrict the opening of the door. Mounting supports shall be on the front of the cabinet. The fixture shall have an on/off switch mounted on the side of the fixture. The fluorescent bulb shall be a F8T5WW.

A fluorescent bulb and fixture shall be installed in cabinet Type 6E, and when specified in other cabinets. The fixture shall be within the upper 3 inches from the top and toward the

door side of the cabinet. It shall illuminate the interior of the cabinet without hampering the vision of service personnel while inspecting the cabinet. The fluorescent bulb shall be a 15 watt, T-12, 18 inches in length. The fixture shall be of a sturdy construction to hold and operate the above mentioned bulb. For Type 6E the cabinet light shall be turned on when the cabinet door is opened and turned off when the cabinet door is closed.

10.4 Cabinet Hubs

The hubs for the cabinets shall be cast aluminum, ASTM B-108 and those standard specifications referenced therein. The bolt pattern shall be as detailed in the Figure 18A-1. The blank shall be a flat plate, 1/4 inch thick. All other hubs shall have a conduit threaded collar that shall be a minimum of 2 inches from the base of the hub. The threaded opening shall be centered within the 3-3/4 inches dimensions of the hub with outside edge of the threaded collar in line with the base of the hub. All hubs shall be provided with stainless steel bolts casted into the hub. The outside of the hub shall provide a smooth design. On the hubs with larger threaded collar(s), the bolting pattern shall be maintained. The following table describes the designations and type of hubs that will be specified on the order or plans.

TABLE 18A-9 (verify with current design details)
CABINET HUB DESCRIPTION

TYPE	OPENING(S) SIZE	OPENING DESCRIPTION
Blank	-0-	no opening, flat plate, 1/4" minimum thickness
Single	3/4 in.	one opening, 3/4" conduit thread
Single	1 in.	one opening, 1" conduit thread
Single	1-1/2 in.	one opening, 1-1/2" conduit thread
Single	2 in.	one opening, 2" conduit thread
Single	2-1/2 in.	one opening, 2-1/2" conduit thread
Single	3 in.	one opening, 3" conduit thread
Double	3/4 in.	two openings, 3/4" each conduit thread
Double	1 in.	two openings, 1" each conduit thread

10.5 Pole Mounted Cabinet Clamp

A pole clamp shall be provided with the controller cabinet Type 3E for mounting the cabinet to the pole. The clamp shall be cast aluminum meeting the requirements for the cabinets and designed to hold the weight of the mentioned cabinets and the equipment contained within. The design shall provide four contact points with the pole and shall be adjustable for pole diameters from 10 inches to 12 inches. The clamp shall be divided into two parts, one half to be attached to the cabinet and the other half to be installed on the

“back” side of the pole. The clamp shall have a slotted opening for coupling the clamp together using 5/8-inch galvanized all thread bolts and nuts. The clamp shall have a flat surface area, 4-1/2 inches x 2 inches minimum that attaches to the cabinet. Two (2) 5/16 inch - 18 tpi, drilled and tapped holes spaced 4 inch center to center shall be centered within the flat area. The flat area shall space the back of the cabinet a minimum of 2 inches from the pole.

- Pole Mounted Cabinet Adapter

When specified, an adapter shall be provided, excluding lag bolts or steel bands. The adapter shall be conformable for mounting to round poles with a 4-1/2 inches or larger diameter. Material for the adapter shall be comparable with aluminum alloy 6061 and have the mechanical strength to hold the weight and loading requirements for the cabinet. The adapter shall accommodate lag bolts up to 1/2 inch and steel banding up to 1 inch wide. The adapter shall have the same mounting bolt pattern and wire way requirement as the hubs stated in Section 17.12.4. The adapter shall be mounted to the cabinet using the same mounting bolts as the hubs, and additional gaskets shall be used between the cabinet, hub, and adapter.

- Adapter Slip-fit, 4-Inch pipe.

The adapter shall slip-fit to a standard 4-inch pipe and shall secure to the pipe with four (4) square headed set screws. The adapter shall be made of cast aluminum or steel designed to hold the weight of the cabinet and the loading characteristics required for the cabinet. The length of the adapter shall be approximately 8 inches long. The adapter shall be attached to the cabinet with 5/8-inch bolts and fitted on a 6-1/2-inch bolt circle.

10.6 Cabinet Interior Panels

10.6.1 General Requirements

All panels shall be made from structural grade sheet aluminum equal to 2024 or 5052 aluminum alloy. Approval from the Department is needed if different material than listed above is used for the panels. The panels shall be attached to the cabinet walls with bolts, nuts, and washers specified elsewhere in this standard. Each panel shall be completely removable or capable of folding down from the cabinet wall without the need to remove any other panel or shelf so that inspections and repairs may be made behind each panel. All panels shall be grounded to the cabinet using a braided copper conductor equaling #6 AWG. All panels shall be sized to fit within the minimum dimension of the cabinet it is specified for as listed in Table 18A-7.

10.6.2 General Wiring Design Requirements

The inspection and repair of any panel shall not require disconnecting or removing wires. When multiple panels are required in the cabinet then the cable shall follow a single route and shall be from the detector/auxiliary panel to back panel to power panel to police panel. Cabling shall conform to the previously stated

requirements for servicing each panel. Cable(s) shall be secured to the panels at the point where it leaves and/or enters each panel. The cable shall be secured to the cabinet wall with a cable clamp at two (2) points equally spaced between the panels on the above stated route. Wiring requirements for ventilation, temperature monitoring, and cabinet lighting shall be from the power panel to each device and shall be neat and in accordance with good wiring practices. A separate, parallel cable route shall be used from the field terminal to the back panel solid state load relay outputs.

10.6.3 Identification of Components, Terminals, and Connectors

Each terminal position, sockets, switches, filters, relays, and fuses shall be permanently labeled by painting, printing or engraving directly onto the panel or terminal strip identifying the position number and/or function of the terminal or device (paper labels of any type will not be accepted). Each harness shall be permanently labeled to identify function or connector with only the following:

TABLE 18A-10
HARNESS LABELS

HARNESS	LABEL	HARNESS	LABEL
NEMA Connector A	"A"	Controller	A
NEMA Connector B	"B"	Controller	B
NEMA Connector C	"C"	Controller	C
Controller Connector D	"D"	Controller	D
Conflict Monitor	"G"	Conflict Monitor	G
Conflict Monitor	"H"	Conflict Monitor	H

10.6.4 Implementation of Equipment Capabilities

The wiring between the panels shall connect the functional inputs and outputs needed to implement the operational capabilities of the equipment and requirements of this standard. Input circuits to the controller for external controls shall not be wired: i.e.; hold, omit, force off, CNA I&II, control status bids, phase next, phase on, phase check, red omit, pedestrian recycle, max I&II, max inh. There shall be no discrete circuit, components or active devices attached to any panel or cabinet wall except as specified. Printed circuit boards are not allowed on any panel.

10.7 Back Panel

The back panel shall be located on the lower half of the back cabinet wall. The controller and conflict monitor harnesses shall be terminated on the upper portion and shall be secured to the top left corner of this panel with non-chafing cable clamps as described

elsewhere in this standard. All wires shall be installed for the D and E connector functions listed in the appendix, between terminal positions and a receptacle on the back panel. The receptacles shall be square flange, with sockets connector, permanently mounted on the back panel, D receptacle - AMP206438-1, E receptacle - AMP2064038-1. The D connector on the harness shall be an AMP 206437-1 or an exact equivalent. An E harness connected to the Emergency Vehicle Detection System shall be provided with the EVDS equipment. The E connector on the harness shall be an AMP 206039-1 or an exact equivalent. The pins and sockets shall be gold finished. (Engineering note: EVDS equipment is specified in a separate document. All cabinets provided to DOTD shall be equipment to receive the EVDS equipment and provide the required functions as stated elsewhere in these standards.)

The wires from the controller harnesses, panel mounted receptacle, and other required devices shall be grouped by associated functions and terminated individually at a position on a terminal strip, (example - all inputs, by cycle, offset ... etc.). The terminal blocks and cabling for each harness shall be separate and have no wires crossing others from a different harness. Each terminal position shall be permanently identified with the associated function in the connecting equipment. Wiring to this panel from other equipment specified elsewhere in this specification shall be given extra lengths to allow movement between controller terminal positions for field changes.

All harnesses shall be 5 feet long from the point that is held by the cable clamp to the connector on the free end. The connector on the free end of the harnesses shall be a designated connector by the manufacturer. Any additional connectors and harnesses necessary to implement the controller and system operations specified herein shall be supplied by the manufacture meeting this standard.

For Type 3E cabinets, the panels shall be constructed in accordance with LA DOTD drawings #18A-3. The harnesses for Type 3E cabinets shall be 3 feet long from the point that is held by the cable clamp to the connector free end.

10.7.1 Connectors

Controller and monitor harnesses shall utilize Mil-C-26482 Series 1 and AMP CPC type series 2 connectors. The controller harness connectors shall be as described elsewhere in this standard. The monitor harness connectors shall be as follows:

TABLE 18A-11
MONITOR CONNECTORS

MONITOR Number of Channels	CONNECTOR
12 Connector A	MS 3116F-22-55SZ
12 Connector B	MS 3116F-16-26S

10.7.2 Harness Wire Termination

The monitor's signal input channels and voltage monitoring circuits shall be terminated on the appropriate terminals. The following shall be terminated at one position in all cabinets: harness wiring listed in NEMA-TS-1, Section 13 except as noted above, each input and output of the load switches, input and output of the controller, and the output of the flash transfer relays. The terminal blocks shall be either single row feed-through or double row type (electrical requirements described elsewhere in this standard). Exceptions to the requirement for single position termination for each wire are AC-, chassis ground, logic ground and flashing outputs. Listed below are the minimum terminals required for each:

- a. Logic Ground - Three (3) adjacent positions.
- b. AC- - a separate copper or brass multi-terminal bus bar shall be mounted near the lowest portion of the panel, adjacent to and horizontally aligned with the signal field terminals. It shall be insulated from the cabinet and connected to AC- on the power panel with a single #6 AWG insulated wire. The bus bar shall be sized to accept 5 - #14 AWG solid wires at each terminal and shall have a minimum of 12 positions. This bus shall be used to terminate all the neutral circuits from cable wired to the signal heads.
- c. Flashing outputs - each circuit of the transfer relay shall have different flashing circuits.

All terminations shall be grouped by function as listed in NEMA TS-1 Standards, Section 13, Tables 13-1 and 13-2. The signal load switch inputs shall be terminated below all other controller and monitor harness termination.

Panels for cabinet Type 3E shall only have terminations of all voltage, monitoring, and coordinator circuits of the controller. The controller load switch controls shall be wired to the load switch receptacle and other requirements shown in drawings #18A-3. A single harness shall contain the circuits for A and B connectors. The connectors shall be offset along the end of the harness by 6 inches. Load switches shall be provided as follows: eight (8) switches, four phase, two (2) overlaps, two (2) pedestrians (Additional details shown on drawing #18A-3).

Type 6E cabinets shall have overlap outputs "A" through "D" wired respectively to load switches 9 through 12. Wiring shall be arranged on the back panel to facilitate connecting the pedestrian outputs to the load switch inputs by moving wires, without adding wire, connectors, or terminal blocks.

(Engineering Note: The only controller outputs and load switch

inputs circuits that are to be terminated on terminal strips are those circuits used for overlap and pedestrian indications. In accordance with the specification these circuits shall be provided to change the inputs of these load switches from either overlap or pedestrian outputs. In addition this will allow the reset circuit for pedestrian isolator cards to be terminated with the correct controller output. This requirement shall be for both the Type 6E cabinets. In reference to logic ground within the cabinets this notation shall apply to all circuits. All reference to logic ground shall be through connector "A" of the controller. In cases where specific controls are used in connector "D", then logic ground of this harness may be used. In all cases logic ground through any connector shall be the same reference within the controller.)

When specified on order or plans, overlaps shall be terminated at different positions than specified above.

10.7.3 Load Switches and Flash Transfer Relays

Signal load switches shall be provided, one for each phase and each overlap. When specified, additional positions and load switches shall be provided for four pedestrian signals in line with the load switches previously specified. All flash transfer relays shall be located on the back panel, adjacent to the load switches. A solid state flasher shall be provided and located as stated below.

The position of the load switches, flashers, and transfer relays shall be between the terminals for the load switch inputs and outputs. In Type 3E cabinets the position of the load switches, flashers, and transfer relays shall be in accordance with drawings #18A-3. The area above the load switches and flasher shall be open to allow the ventilation to flow freely away from the load switches.

The AC+ for the signal load switches shall be terminated as previously specified and be capable of carrying 60 amps, equally distributed to each signal load switch from a terminal strip on the back panel.

The transfer relays shall be operated directly by the voltage to transfer the signal operation from sequential to flashing. No intermediate relay shall be used between the transfer relays and signal operate/flash circuit. The transfer relays shall be energized during normal operation to connect the signal load switches to the field terminals.

10.7.4 Signal Field Circuits

The output from the load switches shall be located on the lowest terminal strip at the bottom of the back panel. Wiring from the signal heads shall be terminated separately for each indication and there shall be no internal cabinet wiring terminated on the same terminal. The inputs and outputs of the flash transfer relay shall be terminated above and adjacent to the load switch outputs. The arrangement of these terminal strips shall allow the selection of either red or yellow signal indications to flash without needing to un-solder or solder connections. The number of signal

circuits which will be transferred to flashing circuits shall equal the maximum number of load switch positions specified. No wiring shall be installed on the terminal for the field wiring.

10.7.5 Power Panel

The power panel shall be mounted on the lower right inside of the cabinet. It shall receive a single phase, 120 VAC, 60 Hz electrical service and shall have three (3) separate terminals for terminating the wires from the service source. This panel shall provide the power required and necessary functions, including cabinet ground, to each panel. The service terminals shall be a mechanical compression type, sized to accept a wire range from #8 to #2 AWG, stranded wire. A ground bus bar shall be located on the lower portion of this panel and terminate all ground circuit within the cabinet. All ground circuits shall be designed for a single path to the ground bar and no ground loops shall be created. The ground bus bar shall be a separate copper or brass multi-terminal bus bar. It shall be mounted directly to the panel and connected to chassis ground input terminal with a single #6 AWG green insulated wire. The bus bar shall be sized to accept 5 - #14 AWG solid wires at each terminal and shall have a minimum of 12 positions. This bus shall be used to terminate all the ground circuits from cable wired to the signal heads. All internal ground wiring to this bar shall be on one end using a maximum of 4 positions.

The power panel components for Type 3 cabinets shall be incorporated on the back panel. Both neutral and ground bus bars shall be located conveniently for installing field wiring. All other requirement mentioned above shall be adhered to. Switches shall be located for easy reach and away from energized parts. (Details shown on drawing #18A-3)

- Control Switches

The following switches shall be located on the power panel and shall perform the functions listed below and labeled as shown:

- a. Cabinet light - ON/OFF - this switch shall control the AC+ to the cabinet light specified elsewhere in this standard. For Types 2, 3, and 4 cabinets the switch shall be part of the fixture.
- b. Test - FLASH/AUTO - The “flash position” of this switch shall allow the signal indications to flash and the control equipment to cycle in its normal manner. The “auto” position will not affect the normal operation of the equipment.

- Breakers

Breakers shall be provided in each type of cabinet. The AC+ power shall have one input and shall be bussed to three (3) separate circuits. The breakers shall be a single pole, molded case, screw mounted on this panel with two (2) #10 screws on a 4-1/2-inch pattern. Each breaker shall indicate visually that

the breaker has been tripped. The following are the functions and labels for each breaker:

- a. Controller power - ON/OFF - this shall be rated for ten amps and control the AC+ power to the controller and conflict monitor. (filtered and suppressed)
- b. Main Power - ON/OFF - this shall be rated for 60 amps and control the AC+ power into the cabinet for all equipment. The power for the auxiliary circuits shall not be controlled by this switch.
- c. Detector Panel Power - ON/OFF - this shall be rated for 10 amps and control the AC+ power to the detector panel used for interconnect relay outputs. This circuit shall not be used for detector card rack and shall not be connected to the suppressor on the power panel.
- d. Auxiliary Power - ON/OFF - this shall be rated for 20 amps and control the AC+ power to the ventilation fan, cabinet light, and convenience outlet. (filtered)

- Surge Protection and Filtration

The power for the control equipment shall be protected by a RFI line filter and high voltage surge arresters. The line filter shall be rated at 60 amps on each AC+ and AC- line. Terminals on the filter shall be for suppression on the main power, neutral, and ground; and separate terminals for line in and out, neutral out supplying the controller and detector panel power to the breakers. The filter shall attenuate signals both from line to load and load to line. The attenuation in both directions shall be a minimum of 50 decibels over the frequency range of 200 KHz to 75 MHz. The impulse life of the protector shall be capable of operating 20 times at peak current. The clamp voltage shall be 340 volts at 20K amps and shall respond to over voltage conditions within 300 nanoseconds. The minimal capability of the protector shall be to discharge a single impulse with a wave shape of 8/20 and current to be 20K amps on each side to ground. The insulation resistance between line to ground shall be 100 mega-ohms.

- Signal Bus Operation

The signal bus power shall be switched individually by normally opened solid state relays rated a minimum of 60 amps, control voltage 120 VAC (Crydon series 1 - A2475 or equal). The solid state relay shall operate within the NEMA temperature range by de-rating the device and using necessary heat sinks. All switches are specified elsewhere and the circuit design shall limit the switched current to 10 amps max.

- Convenience Outlet

The receptacle shall be a feed through, ground fault interrupter type, 20 amps, duplex receptacle. The receptacle shall have three (3) wires from the device to the appropriate terminal on the power panel, (Ground, AC-, and

AC+). The feed through shall supply power to the fan and light.

The convenience outlet installed in Type 3E cabinets shall be mounted on the door. The electrical details shall meet the following requirements and details in drawing 18A-3. The convenience outlet in Type 6E cabinets shall be mounted on the power panel.

- Power Panel Isolation

A clear, non-breakable, 1/4-inch Lexan insulating cover shall be used to shield all open connections and not cover any switch, breaker levers, terminals blocks, bus bars, or convenience outlet. The cover shall be secured in place with screw fasteners and be removable by hand or simple hand tools.

- Generator Bypass Assembly

The cabinet assembly for both Type 3E and Type 6E shall come with the capability to accept a Generator connection to supply complete power to the traffic cabinet. When an external power source is connected, the traffic cabinet shall automatically transfer the AC line current from the external generator. When the external power is removed, the transfer relay will automatically transfer back to the normal AC power, without disruption to the signal operations.

The generator plug shall be a 30 amp, three-prong, flanged male, twist-lock connector. The connector shall be a Hubbel model # 2615 or equivalent, and shall be mounted internally in the cabinet, and accessible through it's own locking access door. The generator access door shall utilize the same type lock and key mechanism for the police door referenced in this specification under section 17.7.6 Police Compartment. A dust cover for both the police key and the generator wire shall be provided on the generator access door. The generator access door shall be mounted flush with the cabinet assembly and shall be hinged for easy access by maintenance personnel.

- Space for "Future" UPS system

Sufficient shelf (third shelf) space shall be provided in the Type 6E cabinet assembly for a "Future" UPS system. Two (2) battery shelves shall be provided that shall be mounted in the bottom of the cabinet assembly on each side of the interior of the cabinet. These shelves shall be easily removable for maintenance and shall hold two (2) 80 AMP type batteries each.

10.8 Detector and Auxiliary Control Panels

A detector panel shall be provided in cabinet Types 3E and located on the left inside wall of the cabinet. The terminals and wires for detector card inputs, controller vehicle detector input test switches, remote communications, and additional functional inputs/outputs

specified shall be on this panel. The upper portion of this panel shall be used for mounting any required terminal blocks. The middle of the panel shall be for vehicle/pedestrian test button and control circuit and field wiring terminals. A six (6) position terminal block with suppressor shall be positioned on the bottom of the panel for communications. There shall be no splices in the wiring.

A separate panel shall be provided for the auxiliary controls including relay bases for interconnection controls, isolating the field circuits and the controller inputs.

10.8.1 Auxiliary Control Function (supplied only if specified on the bid documents and / or plans and specifications, Type 3E cabinets and when specified with any other cabinet)

This panel shall be located on the left lower inside wall of all cabinets, below the detector panel when present, and shall be separate from other panels. Relay bases shall be mounted at the top of this panel and the quantity of bases shall be supplied that will provide the functions required or as indicated on the order. The relays bases shall be wired isolating the field wiring and the controller inputs/outputs for hardwired interconnect. Field wiring will be terminated at fuse blocks, specified elsewhere in this standard. Additional wiring requirements are given below. The relay bases shall be for two-pole octal relays and have screw terminals for all relay pins. The required functions for hardwired interconnect are; resets, cycles, splits, free, flash, and remote common. Wiring from the interconnect terminations described above shall not be included with any wiring or harnesses on the detector panel.

A terminal block shall be provided below the relay bases where the following are to be terminated. Power for this panel shall be supplied by a separate breaker on the power panel. A minimum of three adjacent positions shall be provided for each AC+, AC-, and ground. This power shall be used for supplying master interconnect power and providing power to external equipment. This power shall not be used for equipment power within the cabinet. Logic common from the controller shall also be terminated on a terminal strip. Controller system operations for dials 2, 3, and 4, split 2, 3, and 4, and offset 1, 2, 3, and 4, shall be terminated on the back panel as stated within this standard. Each system operation terminal shall be wired to the front side of the terminal blocks on the back panel and terminated using a compression spade lug to the inputs of the controller. Each wire shall be identified with a sleeve marked, D-2, D-3, D-4, SP-2, SP-3, SP-4, O-1, O-2, O-3, and O-4 respectively. Two terminal positions shall be provided for free in and out, and two positions for flash in and out. Wiring shall be provided for each, one for free and one for flash, from these terminals to the terminals on the front of back panel, terminated using compression spade lugs. Each identified with a sleeve, free marked FR and flash marked FL. This panel shall conform to drawing 18A-3 of this standard.

(Engineering Note: For railroad preemption inputs, we intended to use the pedestrian isolator cards between field and controller inputs. For hardwired interconnect controls, we will move the wiring on the back panel for master or

secondary operation. Similar methods of moving wires will be used to implement other required functions as needed.)

10.8.2 Detector Panel for Type 3E Cabinet

The detector panel shall be located on the inside right wall of Type 3E cabinets. The panel shall have terminal positions for the specified field input circuits. The wiring requirements stated above shall be followed. Terminals shall be provided for eight (8) vehicle and four (4) pedestrian detector input circuits.

The card rack shall follow the specified requirements elsewhere stated, however positions shall be provided for one power supply, two-four channel vehicle detector cards, and two pedestrian isolator cards. The wiring for the rack shall be formed to follow the hinge of the door without damage to the wiring.

10.8.3 Detector Panel Test Switches

Detector test switches shall be provided on all detector panels. These switches shall be positioned in between the terminal blocks for the field wiring and adjacent to the input of the channel that the switch is for. Access to the switches shall not be interfered with wires or suppressor. Each switch shall be a momentary push button, normally open switch. There shall be a switch for each detector channel supplied in the cabinet and for each pedestrian call circuit (2 for 4-phase, and 4 for 8-phase), as per this specification, order, plans, or any addendum. Each switch shall be permanently labeled with the nomenclature of the function it provides (Ø # or Ø ##). The function of the switches shall be to place a logic ground on the controller vehicle, pedestrian, and system detector inputs. The wiring shall be terminated on the front of the back panel at the associated controller input terminal. A compression type spade lug shall be use and each wire marked with a identification sleeve as follows: VB-Ø1, VB-Ø2, VB-Ø8, PB-Ø2, PB-Ø4, etc.

10.8.4 Field Wiring - Detector and Auxiliary Panels

The loop lead-in, pedestrian field push button shall be terminated on the sides of the detector panel, the communications shall be terminated on the bottom of the detector panel, and the interconnect and field inputs/outputs shall be terminated on the bottom of the auxiliary panel. Each channel, vehicle and pedestrian, shall be terminated at two adjacent positions for inputs. On the auxiliary panel six NON type fuse holders and one remote common terminal shall be positioned on the bottom of the panel for hardwired interconnect.

The specified lightning protection shall be connected to the designated field terminals.

10.8.5 Communication Harnesses

All additional harnesses required for connecting the modem, line drivers, controller, master, and system hardware in addition to the specified connectors shall be provided and terminated in a fashion required by the manufacturer. Additional harnesses shall not negate any harness specific by this standard. Approval of these harnesses shall be obtained from the Department.

10.8.6 Lightning Protection

All detector and data field wiring shall be terminated on the required terminal block. Minimum voltage clamping shall be 30 volts for both differential and common mode. Current carrying capabilities shall be 400 amps in differential mode and 1000 amps in common mode. Response time for detector protection shall be 40ns and for data lines shall be 1 to 5 ns. The devices shall be mounted to the panel and the leads terminated on each field terminal.

All 120 volt field circuits shall be protected on the equipment side of the fuse by a surge protector. Operating line voltage shall be 120VAC, peak surge trip point for 600 volts/microsecond impulse shall be less than 890 volts. Response time shall be less the 200 nanosecond at 10KV/microsecond. Surge handling ability shall be 20K amps. The device shall be mounted on the grounding stud adjacent to the protected terminal.

10.8.7 Police Panel

The police panel shall be located in the police compartment previously specified and provide switches which are accessible when the police compartment door is opened. The following list of switches shall be located on this panel and be wired to their appropriate circuits to provide the functions identified below:

- a. Flash Control Switch - Flash/Normal - this switch shall control the signal output from the controller to cause them to flash in the "Flash" position and to initialize the controller to the start-up phase unless the conflict monitor has detected a conflict. If the monitor has placed the equipment on flash, then this switch shall be inactive. The "Normal" position of the switch shall cause no effect to the signal circuits and shall allow the control equipment to function in its prescribed manner.
- b. Signal Shut-Down - On/Off - the "On" position of this switch shall allow the signals to operate in normal manner. The "Off" position of the switch shall cause the signal indications to become dark, regardless of whether the signals were flashing or operating normally and to initialize the controller to the start up phase unless the conflict monitor has detected a conflict.
- c. Manual Control - Auto/Manual - All necessary wiring, (manual control enable, interval advance, logic ground) shall be routed to the panel and terminated. A switch shall be provided only when specified and switch the

function of the controller from normal operation in the “Auto” position to a manual advance operation in the “Manual” position by a manual push button to advance the controller in accordance with the NEMA standards. In addition to the switch, a manual control shall be provided. The cord shall be terminated on a terminal strip attached to the back of the police panel. The cord shall be weatherproof and coiled, having a maximum retracted length of eight inches and a minimum extended length of five feet. The cord shall be attached to the panel with a cable clamp, and fitted with strain relief bushing at the point it is routed through a five-eighths inch hole in the panel. The manual control shall be on the free end of the cord. The manual control and the connection to the cord shall be weatherproof. A hand grip shall be constructed for normal use by being held in one hand and a momentary contact switch can be activated with the thumb. This control shall be operable between the above mentioned lengths.

The back of the panel shall have an aluminum shield to prevent personnel from accidentally coming in contact with the terminals of the switches or terminal strip. With the cover in place, it shall provide visual inspection of the back of the panel and shall not interfere with any equipment when the main door is closed.

11.0 CABINET WIRES AND WIRING

The wiring in the cabinet shall withstand the environmental temperature range as stated in NEMA TS-1. The insulation shall remain flexible over the temperature range and will not begin melting, causing the insulation to reduce in thickness. The insulation shall meet Specification MIL-W-16878D, 105 degrees, 600V, (MIL), heat resistant, polyvinylchloride or approved equal. The wire shall be 600 volts and color coded according to the following list:

TABLE 18A-12
WIRING COLOR CODE

HARNESS	COLOR
Controller harness and wiring	Blue
Conflict monitor Harness and wiring	Red
Detector, preemptor, and interconnect wiring	Yellow
All AC+	Black
All AC-	White
All Controller Logic Ground	White/Black Stripe or White/Green Stripe
All Chassis Ground	Green

The wire shall be stranded copper and sized to carry 125% of the design current and a minimum #22AWG. All signal circuit wiring shall meet the above stated size and be a minimum of #16AWG.

All circuits shall be wired using a single conductor; therefore, parallel wiring is not an acceptable method of meeting wire size requirements as stated above. The wires shall be terminated individually by a solder less compression type spade lug appropriately sized or by soldering. All wiring shall be installed having a zero tension after installation.

Wire bundles shall be held in cable form by lacing tape, spiral wrap, or plastic sheathing. The lacing tape shall be flat, braided nylon and 0.090 inch wide, equal to ICO-Rally type LTN-2. The spiral wrap shall be correctly sized to fit the wire bundle and be a weather-resistant polyethylene equal to Panduit spiral wrapping. The insulating tubing shall be clear colored and sized to fit the wire bundle, equal to Alpha PVC-105 plastic tubing. Cable ties are restricted from use on cable bundles between panels and equipment harnesses. Cable ties may be used to bundle wire on panels only. Cable ties shall be self-locking and have properly applied tension according to the manufacturer's specifications. The ties shall be weather resistant nylon equal to T & B ties (MX series).

12.0 CABINET MECHANICAL AND ELECTRICAL HARDWARE

All hardware shall meet the environmental requirements of the controller. All fastening devices, (bolts, washers, screws, etc.), shall not rust when exposed to weather. These shall be hot dipped galvanized, stainless steel or brass. All electrical hardware shall be sealed and electrical contacts protected against moisture and corrosion.

12.1 Terminal Blocks

Terminal blocks shall be multiple terminal, one piece, rated at a minimum of 300 VDC for all 24 VDC control circuit terminations and a minimum of 600 VDC for all 120 VAC circuits. All field terminal blocks shall be multiple terminal, one piece, rated a 600 VDC and 20 amps. Exceptions to the above requirement for 600 VDC terminal blocks used with the 120 VAC terminations are the 120 VAC terminations of the controller, monitor, and detectors, which are permitted to be terminated on a 300 VDC terminal block. Another exception is where intermixing terminal blocks would result from the above requirement then the block to be used shall be determined by the voltage of the largest number of terminations on that block. The minimum current rating of all terminal blocks shall be 15 amps unless otherwise specified. The minimum amperage for the 120 VAC termination on the power panel shall be 60 amps. Any contradiction between circuit description and hardware restriction shall be resolved by using the larger requirement specified.

In addition to the above requirements for voltage terminations a minimum size screw shall be used. The terminal blocks shall have a minimum screw of #6 for low voltage circuits for the electronic equipment and #8 for all field termination. The power terminal shall be a barrel type screw tightened lug.

12.2 Wiring Terminals

All compression terminals shall be constructed with a base material of fine grade high conductive copper per QQ-C-576 and tin plated per MIL-T-10727 plating process for durable corrosion resistance against salt spray and most chemical fumes. The insulation shall be

made of vinyl. The terminal shall be installed with tooling recommended by the manufacturer to meet the performance requirements of MIL-T-7928. The use of ring or spade terminals is not being precluded by the above requirement. Each terminal shall be correctly sized to fit the wire and terminal screw.

All soldered connections shall be made using the designed temperature for the solder being used and the location of the connection. The connection shall be made preventing a cold solder joint and excessive winking of the solder into the wire. The insulation of the wire shall not be damaged by excessive overheating at any point on the wire.

12.3 Multiple Pin Connectors

All multiple pin connectors shall be wired in accordance with the connector manufacturer's recommendations or applicable MIL specifications. The type of connector shall be in accordance with this standard, NEMA TS-2 TYPE 2, and as listed below.

Unused sockets and pins shall not be installed in the D connector. A cable clamp designed for each connector shall be installed securely to prevent excessive strain on the wires from being transmitted to the contacts inside the connector housing.

12.4 Switches

All switches, except the detector push button test switches, shall be heavy duty toggle switches and meet the MIL-MS-35059 Series Standards, rated at 20 Amps/125 VAC. The level shall have a seal for sand, dust, and 15-foot water submersion. The terminals shall be threaded for screws and have a tinned finish. Mounting shall be by two (2) hex nuts and two (2) internal-tooth, lock washers on a 1/2-inch shank through which the toggle lever is mounted. The number of poles and lever positions shall be determined by the applications previously stated.

12.5 Load Switches and Relay Bases

The load switch and the flash transfer relay sockets shall be rigidly mounted on the back panel. The insulating ridge on the front of the socket shall be reinforced with a metal mounting ring designed by the manufacturer of the socket. This ring shall be secured to the socket with a minimum of two (2) screws and the ring fastened to the panel. Both sockets shall a minimum current rating of 15 amps, individual contacts, voltage rating of 1750 volts rms, pre-grounded, or grounding pin connected to chassis ground.

All relay bases used for special circuits specified previously, and not otherwise specified, shall be rated a 300 VDC and 10 Amps. Bases shall be front-panel mounted and shall have a closed back for insulation from the panel. The socket shall be octal and wired to barrier type terminals permanently numbered. Terminal screws shall be tinplated, #6-32 with captive nuts, and shall accept #20 to #12 AWG wire.

12.6 Cable Clamps

All cable clamps shall have a metal loop and cushion made with a general purpose neoprene. The metal shall be aluminum 20204-T4 or stainless steel per Specification MIL-S-6721, annealed (321 or 347). The neoprene shall meet AMS Specification 3209. The clamp shall be sized to grip the cable it is being used on without damaging any insulation.

12.7 Fuses and Holders

All fuses located on the all removable electronic equipment shall be a ¼ inch by 1-1/4 inch glass tube fuse rated at a minimum of 125 VAC. All panel mounted fuses shall be U.L. Class "H" fuses rated at 250 VAC, fast acting. Fuses shall be provided and equal to Type NON 0-30 Amps.

The fuse holder shall be constructed of a general purpose phenolic material U.L. listed for 250 VAC. The fuse holders shall have barriers on each side of the fuse and shall have a screw type terminal.

12.8 Relay and Motor Suppressor

A suppressor shall be installed on all AC relay coils and motor inputs. The suppressor shall be a series resistor-capacitor, 100 ohms-0.1 microfarad, and rated for 600 volts.

12.9 Identification Sleeves

Identification sleeves shall be supplied on specified wires. The sleeve shall have the required identification printed or typed with a minimum size of pica-pitch 10. The sleeve shall be installed on the wire providing a self-laminating protective shield over the legend. Acceptable material shall be transparent, 3.5 mil, vinyl film with acrylic pressure sensitive adhesive. The operating temperature range shall be -40° C to 80° C. The size of the label shall provide sufficient area for the printed identification.

Application of the sleeve onto the wire shall be neat and smooth completely protecting the identification label.

13.0 TESTING

A test(s) shall be performed on the cabinet containing the completely assembled equipment and control equipment by the manufacturer prior to shipment. Malfunctions or defects shall be corrected and the equipment retested. The complete log beginning with the first test, showing the results of the all tests, shall be delivered with the equipment. The manufacturer shall furnish certification with the documentation required in Section 24, stating that the results of the test are true and accurate and stating the name and title of the person conducting the test. The test shall require the operation of the equipment with each signal circuit connected to an incandescent load of at least 600 watts. The equipment shall operate sequentially and continuously for at least 48 hours, as stated above, in an environment having a minimum temperature of 140°F.

The complete system, including all local controllers, cabinets, on-street master controller, and

modems shall be assembled and interconnected at the point of manufacture.

The system shall be completely performance tested and a written test report submitted in the documentation required in Section 24. The Engineer reserves the right to an on-site system inspection at the point of manufacture to witness the system operation and the performance test of the system.

After installation and debugging of all central control equipment, local controllers, detectors, communications, and other system hardware and software elements, the system shall be required to complete a 30 day period of acceptable operation. The system test shall fully and successfully demonstrate all system functions using live detector data and controlling all system-controlled intersections.

14.0 TRAINING

Formal classroom training and “hands-on” operations training shall be provided for personnel designated by this agency. The engineering, operations and maintenance training shall take place at locations within the state of Louisiana designated by this agency. The technician training shall take place at the manufacturer’s facility. Classroom training shall be given for the engineering, operations and maintenance sessions.

Three (3) training sessions are required during the contract period. Two (2) maintenance sessions, one (1) engineering session shall be given. The engineering session shall provide for a maximum of twenty-five (25) people. Each maintenance session shall provide for a maximum of fifteen (15) people. Copies of course materials shall be supplied to and retained by each attendant. Training shall occur after delivery of initial order, but before one year after date of final acceptance of initial order. The manufacturer shall submit for each type of session, syllabuses to the Traffic Signal Engineer for approval before classes are scheduled.

14.1 Maintenance Training

Training for maintenance personnel shall include detailed, field level troubleshooting and basic interrogation of the controller unit. The training shall consist of two (2) sessions. One (1) session shall be remedial and one (1) session shall cover more advanced material. Each session shall be three (3) days in length. Course content shall emphasize information required to successfully pass the below specified tests.

Maintenance personnel shall be tested by the vendor as to their ability to repair and/or diagnose simulated failures, and to gather basic information about a particular controller unit (i.e., min time, conflicting and non-conflicting phases, etc.). There shall be at least ten (10) controller/cabinet configurations per session type. Cabinets, controllers and miscellaneous materials shall be supplied by the Department. Wiring and programming necessary to conduct the tests shall be performed by the vendor. The vendor shall recommend at least ten (10) simulated failures, timing schemes and other configurations to be used for each type of test. The Department shall supply the vendor with the final, approved test configurations, however, the vendor shall not be required to perform more than six (6) hours of wiring or programming in development of the test configurations.

Final test questions shall be supplied by the Department. A Department representative will be present at all time to assist the vendor in administering the test.

14.2 Engineer Training

Training for engineering personnel shall focus on implementing traffic engineering data with the controller. The manufacturer shall provide one (1) two-day session for a maximum of twenty –five (25) participants.

The first day of the session shall emphasize implementing traffic engineering data and include, at a minimum the following:

- a. Programming an actuated, coordinated controller based on intersections provided by the Department.
- b. Theory and operation of volume density operation and associated programming methods.
- c. Theory and operation of three- and four-phase diamond sequencing and associated programming methods.

The second day of the session shall emphasize basic operation and interrogation of the controller. The training topics shall include as a minimum:

- a. How to enter commands (System software, utilities, and disk management)
- b. Operation of all devices
- c. Generation and editing of arterial master and intersection controller databases
- d. Uploading/downloading of arterial master and intersection controller databases
- e. Procedure for enabling dynamic displays
- f. Explanation of the communication system

15.0 WARRANTY

The system equipment shall be warranted for a minimum of one year. All warranty periods shall begin at the date of acceptance by the Department.

15.1 Documentation

Detailed technical information on material being offered shall be supplied with the bids for equipment directly shipped to the Department and with the material submittal for equipment being installed on projects. Information shall be for all items required by this specification and on the order or in the plans.

Manuals shall be supplied for all equipment and components of the system. The manuals supplied for software, peripherals, and modems shall be from the original source. The manual shall be comprehensive, easy to use and understand, and completely descriptive of the product.

15.2 Closed Loop System Operation Manual

- a. Step-by-step system installation procedures

- b. Operating instructions
- c. System set-up procedures
- d. Explanations and descriptions of data entry procedures
- e. Menu item descriptions

15.3 Equipment Manual

- a. Technical descriptions
- b. Operating instructions
- c. Theory of operation
- d. Detailed schematic diagrams
- e. Assembly drawings
- f. Wiring diagram
- g. Troubleshooting procedures to assist the maintenance staff in the identification and isolation of malfunctions
- h. Parts list

15.4 Cabinet Wiring

Complete wiring details shall be shown on the drawings. The drawings shall use the same nomenclature to identify the various components as referred to in this standard. If no name was mentioned in this standard then a reasonable nomenclature shall be used. A legend shall be provided on all drawings identifying acronyms and symbols. Two (2) drawings shall be provided with each cabinet. The DOTD specification shall be followed when supplying documentation for projects.

APPENDIX

PIN/SOCKET ASSIGNMENTS FOR D CONNECTOR ON BACK PANEL

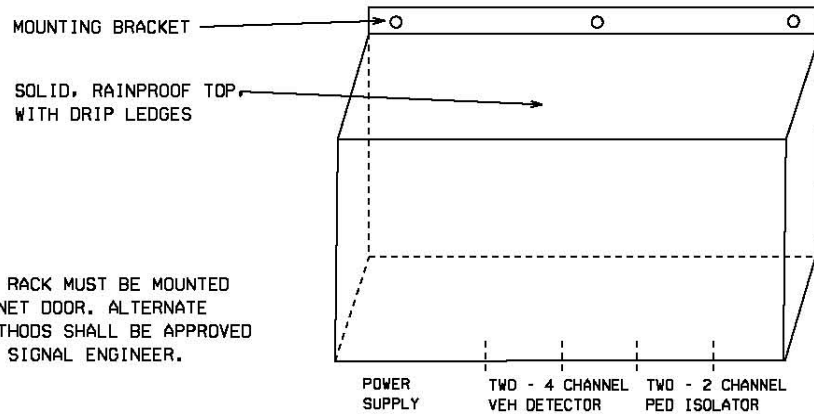
PIN FUNCTION	PIN FUNCTION
1 OFFSET 1 IN	28 SYSTEM DET. 4/DETECTOR 16S INPUT
2 CYCLE 2 IN	29 SYSTEM DET. 5/DET. #2b-1P INPUT
3 CYCLE 3 IN	30 SYSTEM DET. 6/DET. #2a INPUT
4 FLASH IN	31 SYSTEM DET. 7/DET. #1b-5P INPUT
5 OFFSET 2 IN	32 SYSTEM DET. 8/DET. #1a INPUT
6 OFFSET 3 IN	33-34 SPARE
7 INTERCONNECT FREE	35 CONTROLLER INTERLOCK DIAMOND
8 SPLIT 2 IN	36 COMP. SEL 1
9 SPLIT 3 IN	37 COMP. SEL 2
10 SPL FUNCTION 2 OUT (TBC)	38 COMP. SEL 3
11 COMPUTER ON-LINE	39-41 SPARE (DO NOT USE)
12 THREE PHASE DIAMOND SELECT	42 CABINET INTERLOCK DIAMOND
13 FOUR PHASE DIAMOND SELECT	43 SPL FUNCTION 1 OUT (TBC)
14 RESERVED	44 SPLIT 3 OUT
15 RESERVED	45 SPLIT 2 OUT
16 EXT RESYNC INPUT	46 INTERCONNECT FREE OUT
17 MASTER SELECT	47 OFFSET 3 OUT
18 SYNC INPUT	48 OFFSET 2 OUT
19 PREEMPT 1 IN	49 FLASH OUT
20 PREEMPT 2 IN	50 CYCLE 3 OUT
21 PREEMPT 3 IN	51 CYCLE 2 OUT
22 PREEMPT 4 IN	52 OFFSET 1 OUT
23 PREEMPT 5 IN	53 +24 VDC
24 PREEMPT INTERLOCK	54 LOGIC GROUND
25 SYSTEM DET. 1/DETECTOR 45P INPUT	55 CHASSIS GND
26 SYSTEM DET. 2/DETECTOR 25S INPUT	56 RESERVED
27 SYSTEM DET. 3/DETECTOR 18P INPUT	57 RESERVED

PIN/SOCKET ASSIGNMENTS FOR E CONNECTOR ON BACK PANEL

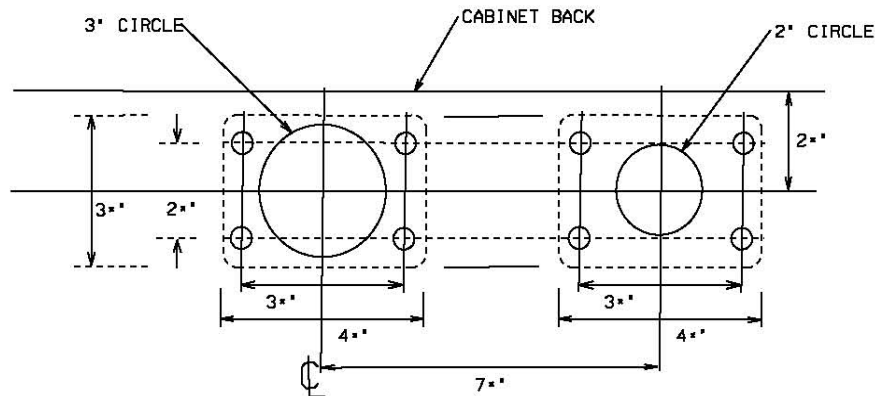
PIN FUNCTION	PIN FUNCTION
1 AC+	11 PREEMPT 3
2 AC-	12 PREEMPT 4
3 CHASSIS GROUND	13 PREEMPT 5
9 PREEMPT 1	15 LOGIC GROUND
10 PREEMPT 2	

DETECTOR CARD RACK MOUNTING SCHEME

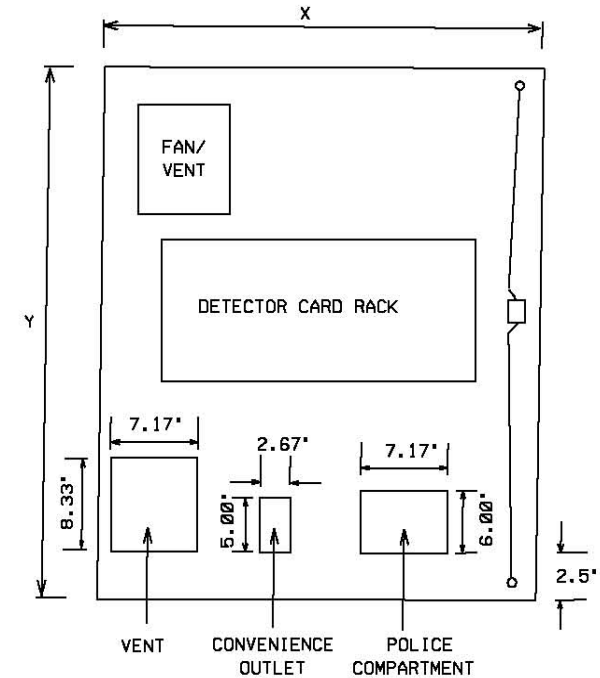
TYPE 3 CABINET ONLY



TYPE 2 & 3 CABINET BOTTOM - PLAIN VIEW



PANEL DETAIL (TYPE 3 CABINET DOOR)



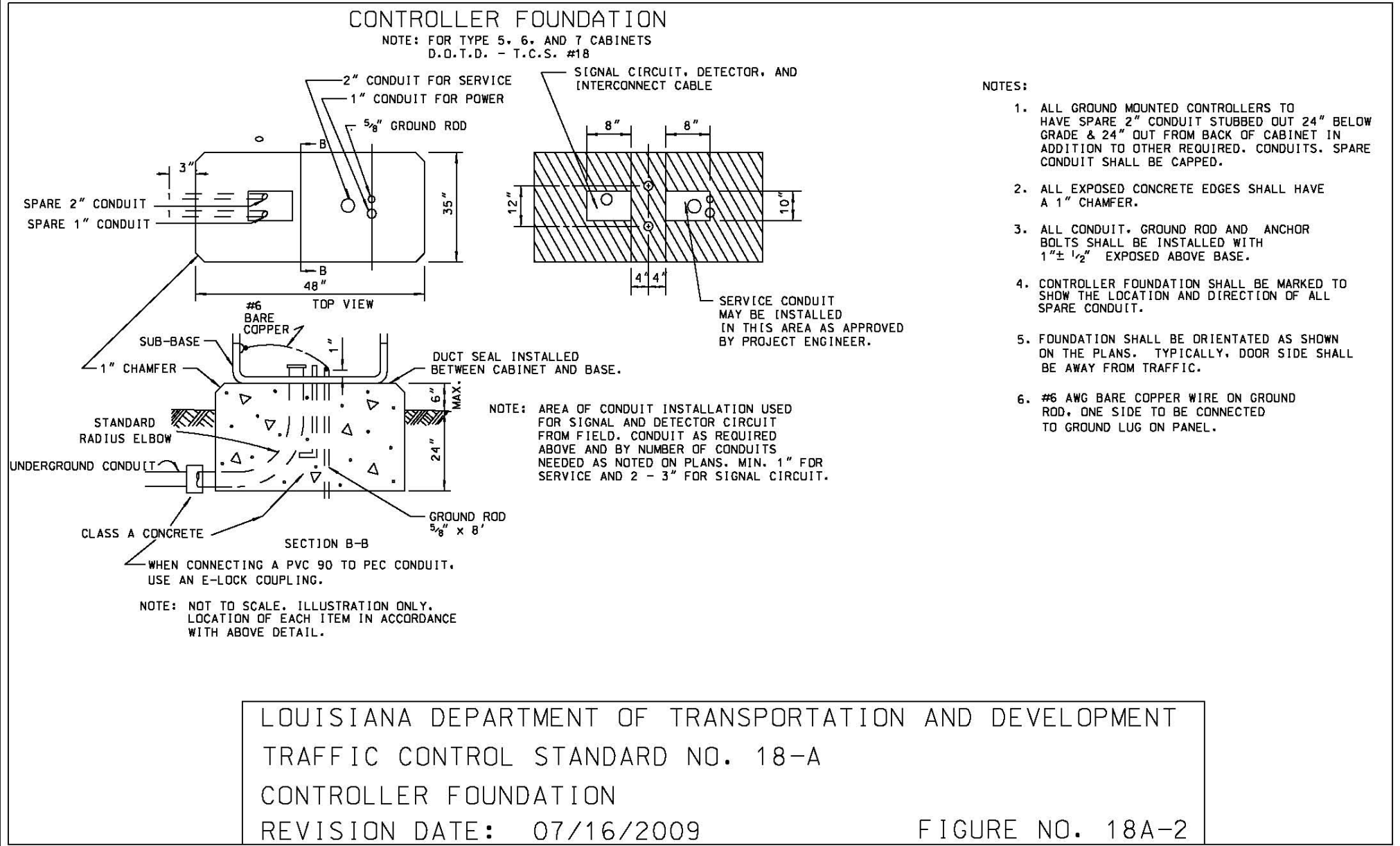
NOTES: DIMENSIONS DEFINE MAXIMUM AREA THAT SHALL BE USED BY ALL COMPONENTS AND MOUNTING HARDWARE FOR THAT DEVICE OR COMPARTMENT.

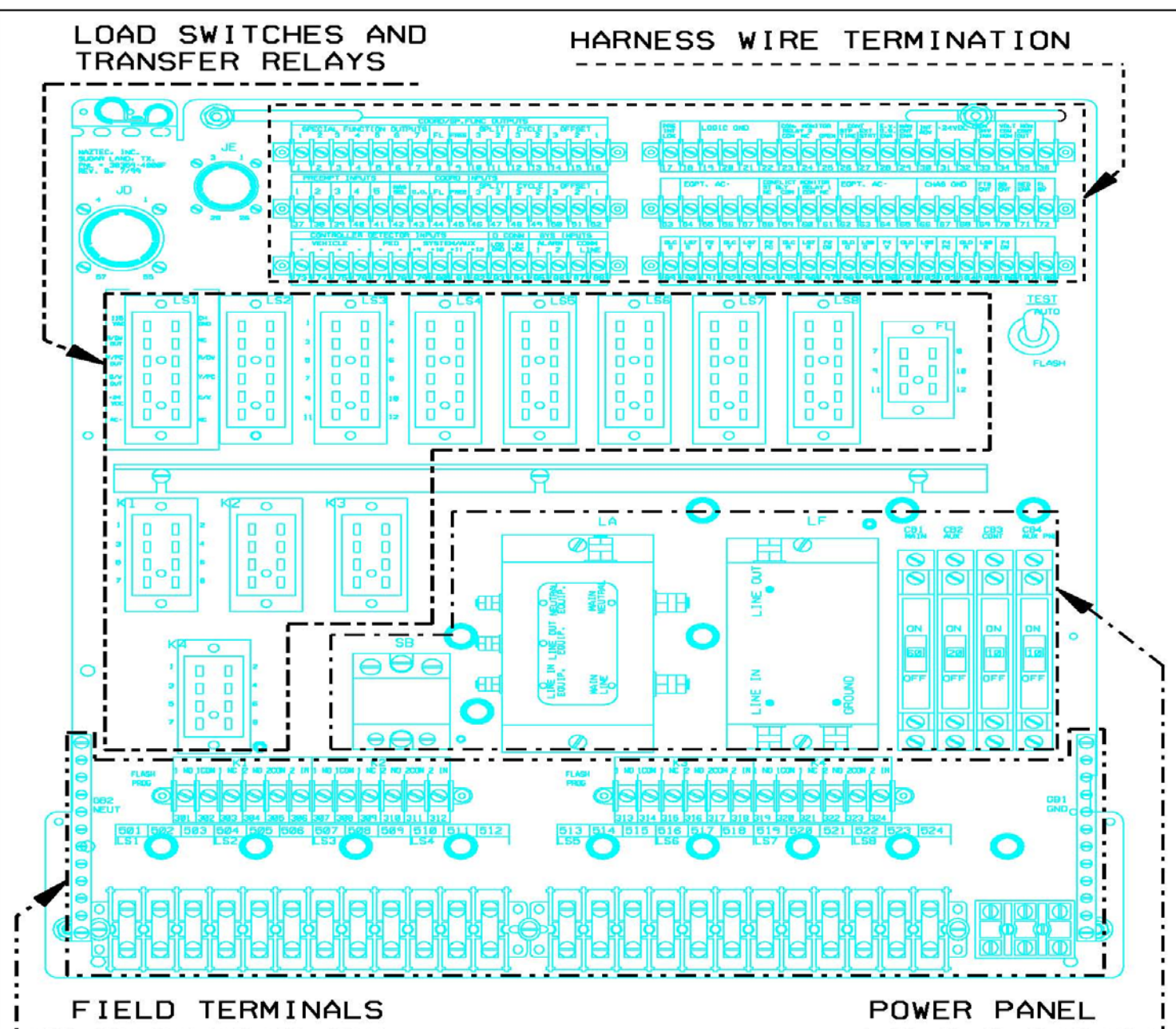
VENT, CONVENIENCE OUTLET, POLICE COMPARTMENT AND LOCK ARM SHALL BE EVENLY SPACED ACROSS THE WIDTH OF CABINET DOOR.

FOR X AND Y DIMENSIONS, SEE TCS 18A.

LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
TRAFFIC CONTROL STANDARD NO. 18-A
CABINET DOOR MOUNTING SCHEME
REVISION DATE: 07/16/2009

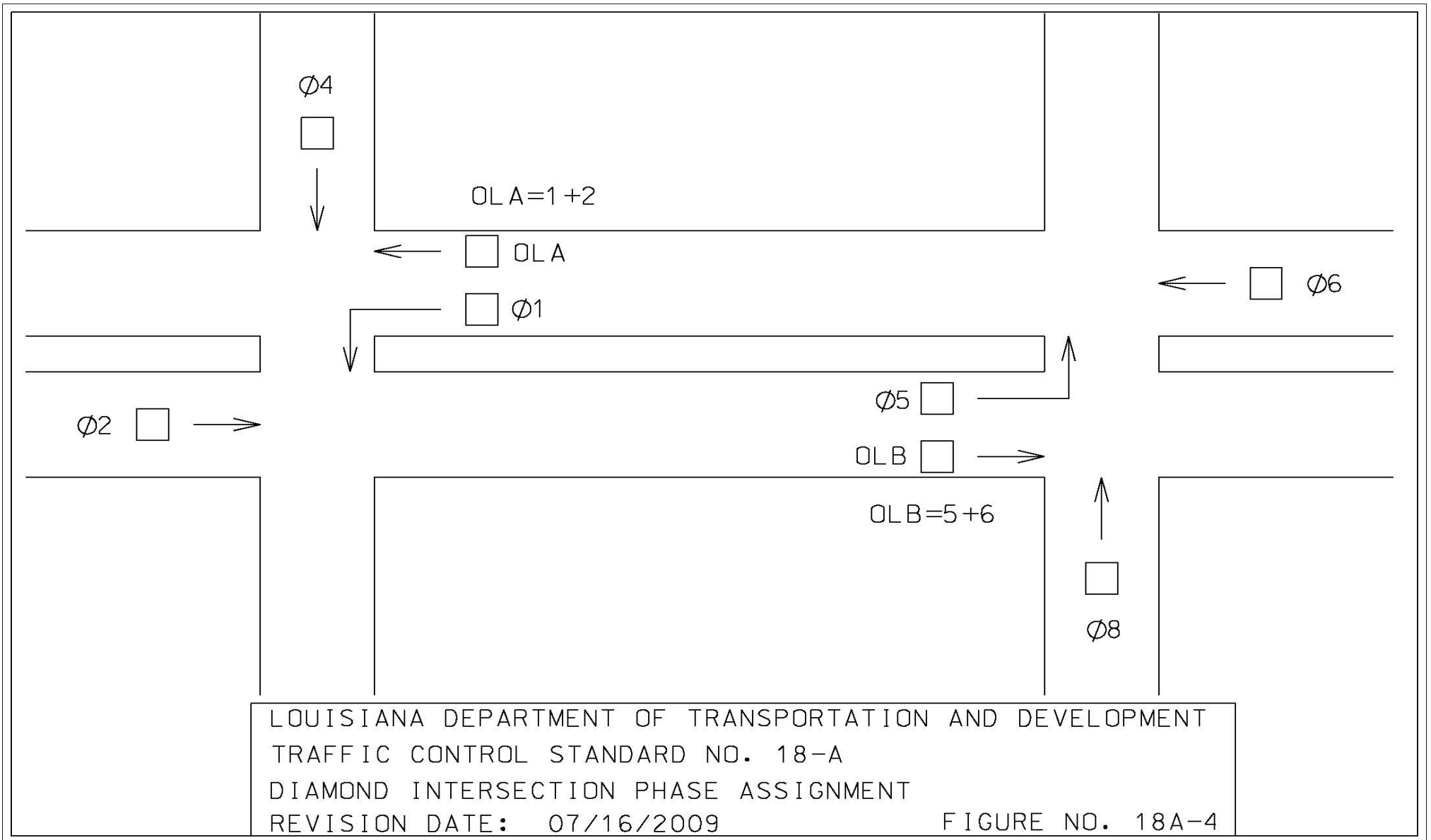
FIGURE NO. 18A-1

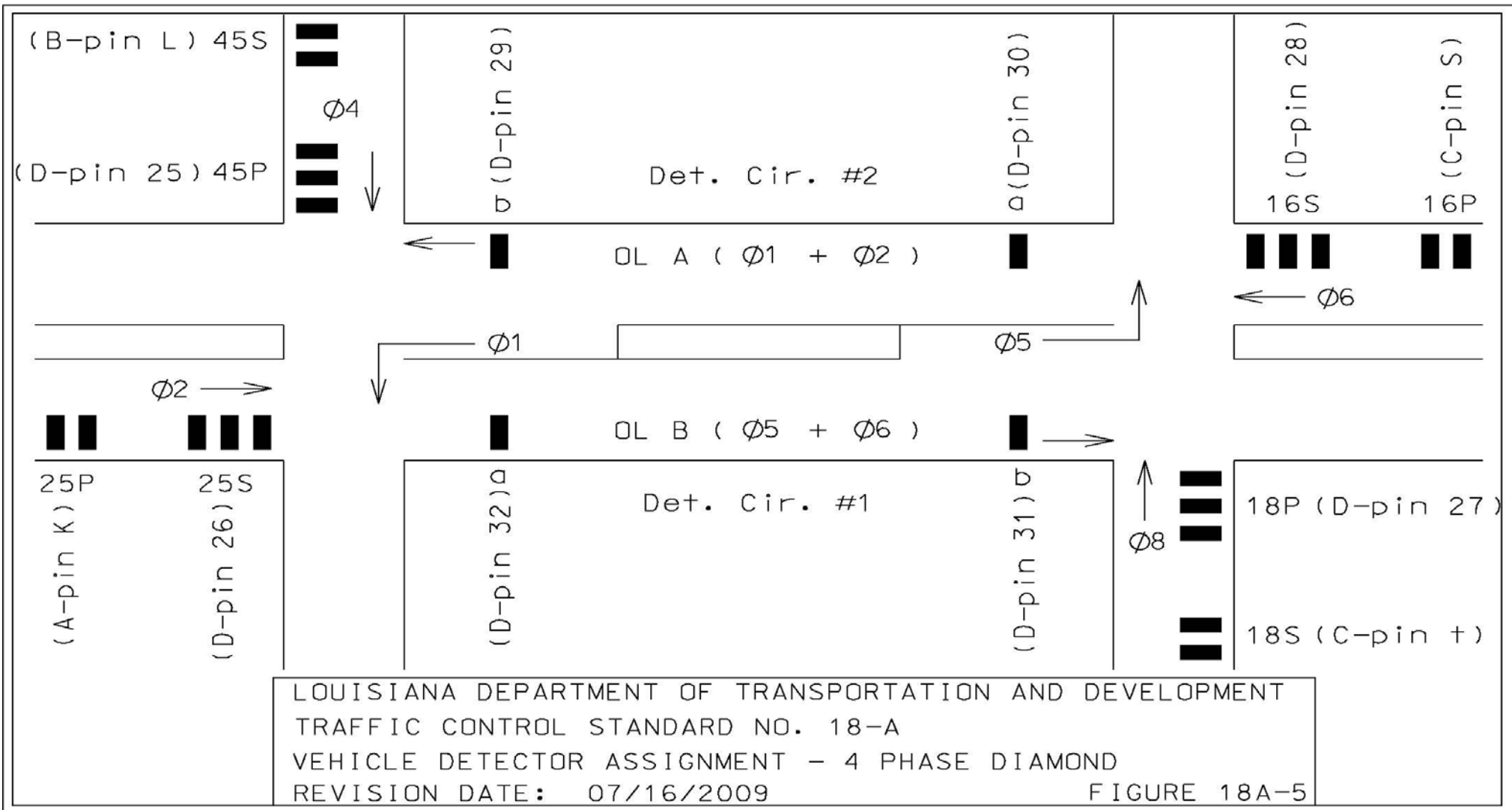


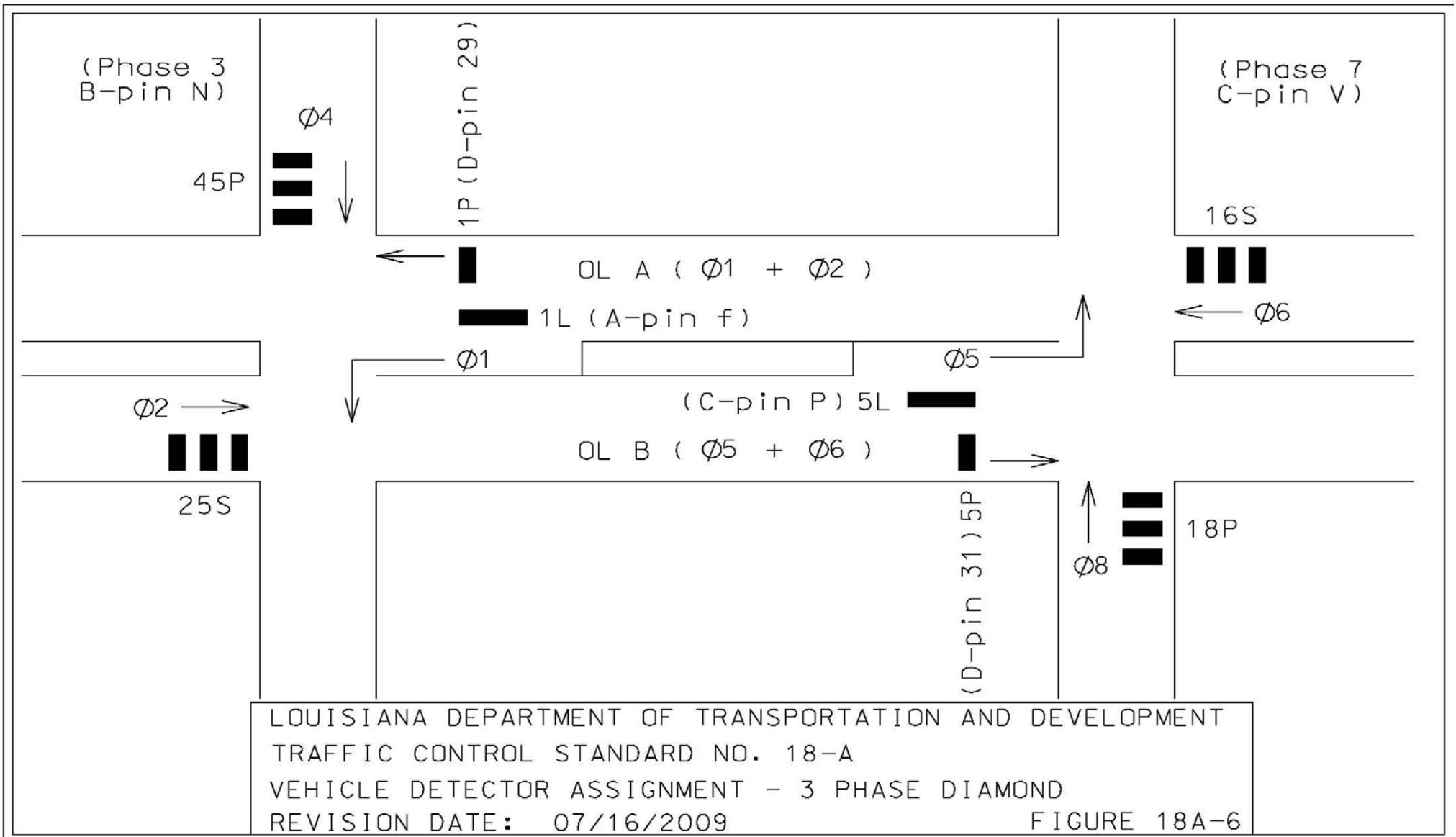


LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
TRAFFIC CONTROL STANDARD NO. 18-A
CABINET BACK PANEL MOUNTING SCHEME
REVISION DATE: 07/16/2009

FIGURE NO. 18A-3







\$\$\$this is the pathname including directory path and design file name\$\$\$

SDATES

STIMES

STATE OF LOUISIANA
DEPARTMENT OF TRANSPORTATION
PLANS OF PROPOSED
STATE HIGHWAY

INDEX TO SHEETS

DESCRIPTION	SHEET NO.
TITLE SHEET	1
GENERAL NOTES & LOCATIONS	2,2a,2b
ESTIMATED QUANTITIES	3
TRAFFIC SIGNAL DETAILS	4 - 14

F.A.P. NO. H011407
STATE PROJECT NO. H.011407

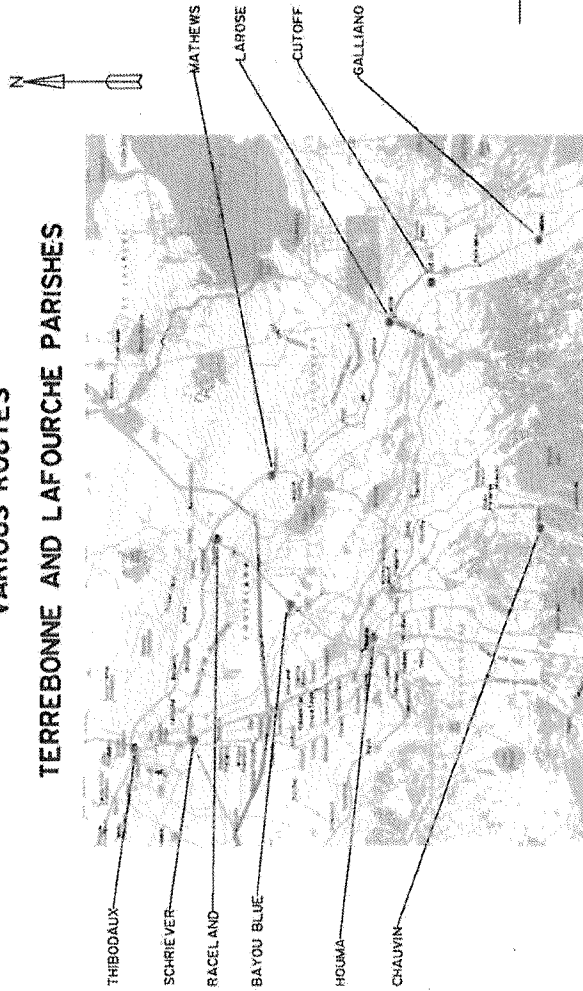
STANDARD PLANS

STANDARD PLAN	REVISION DATE
TTC-00-A	03-12-2013
TTC-00-B	03-12-2013
TTC-00-C	03-12-2013
TTC-00-D	03-12-2013
TTC-01	03-12-2013
TTC-02	03-12-2013

DISTRICT 02H CONTROLLER UPGRADE

VARIOUS ROUTES

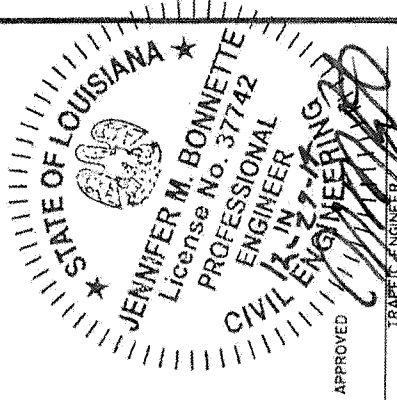
TERREBONNE AND LAFOURCHE PARISHES



TYPE OF CONSTRUCTION: Remove and replace existing signal controller, and related work.

NO.	DATE	REVISION DESCRIPTION	DATE	RECOMMENDED	DATE	APPROVED
0	01/08/15	REVISED INDEX, NOTES & QUANTITIES	1/8/15	JMB	1-12-15	2014

NOTE:
THE 2006 LOUISIANA DOTD STANDARD SPECIFICATIONS FOR ROADS AND BRIDGES,
AS AMENDED BY THE PROJECT SPECIFICATIONS, SHALL GOVERN ON THIS PROJECT.



APPROVED

TRAFFIC ENGINEER

DATE

APPROVED

CHIEF ENGINEER

12-29-14
DATE

TITLE SHEET		DISTRICT 02H CONTROLLER UPGRADE	
DESIGNED: J. BONNETTE	CHECKED: A. FILLASTRE	DATE: 11/20/2014	SHEET: 1 of 1
DETAILS: J. BONNETTE	CHECKED: A. FILLASTRE	DATE: 11/20/2014	SHEET: 1 of 1
DISTRICT 02H	FEDERAL PROJECT: H011407	STATE PROJECT: H.011407	

GENERAL NOTES

SCOPE OF WORK: WORK SHALL CONSIST OF REMOVING EXISTING TS1 & TS2 CONTROLLERS AT THE INTERSECTIONS CONTAINED HEREIN AND INSTALLING NEW ATC CONTROLLERS AND NEW GPS AS LISTED.

ALL WORK SHALL BE LIMITED TO NON PEAK HOURS. THE CONTRACTOR SHALL CONSULT THE DISTRICT TRAFFIC OPERATIONS ENGINEER, PROJECT ENGINEER AND SECTION 45 (TRAFFIC SERVICES) TEN DAYS PRIOR TO EACH NEW INSTALLATION.

POLICE OFFICER SHALL BE ON LOCATION BEFORE, DURING, AND AFTER THE INSTALLATION FOR TRAFFIC CONTROL WHEN SIGNAL IS TO BE SHUT DOWN FOR CONTROLLER UPGRADE.

ALL NEW CONTROLLERS THAT ARE TO BE USED AS MASTER CONTROLLERS SHALL HAVE ALL REQUIRED SOFTWARE.







ALL NEW CONTROLLERS SHALL HAVE ETHERNET CAPABILITY.

SIGNAL TIMINGS IN THE FORM OF AN UPDATED TS1, SHALL BE PROVIDED DURING THE PRE-CONSTRUCTION MEETING BY DTOE TO BOTH THE CONTRACTOR AND SECTION 45.

NO REWIRING OF SIGNALS CABINETS SHALL BE REQUIRED. IF PROVIDED TIMINGS REQUIRE REWIRING, CONTACT DTOE FOR TIMING ADJUSTMENTS.

THE DTOE SHALL PROVIDE A LIST OF ALL SIGNALS UNDER ANY MAINTENANCE CONTRACT FOR THE CONTRACTOR TO CONTACT THE RESPECTIVE MAINTAINING AGENCY PRIOR TO SITE INSTALLATION.

7 DAYS PRIOR TO INSTALLATION THE CONTRACTOR WILL PROVIDE SECTION 45 AND THE DTOE WITH A STREETWISE ELECTRONIC FILE AND TS1 USED FOR TIMING INPUT FOR CHECKING.

				01/08/15		REVISED NOTE	JMB	DESIGNED J. BONNETTE	PARISH	DISTRICT 02H	SHEET NUMBER
								CHECKED A. FILLASTRE	FEDERAL PROJECT	H011407	2
								DETAILED J. BONNETTE			
								CHECKED A. FILLASTRE			
								DATE 11/20/2014	STATE PROJECT	H.011407	
								SHEET 1 of 1			
GENERAL NOTES		DISTRICT 02H CONTROLLER UPGRADE		NO.		DATE	BY	REVISION DESCRIPTION			

\$\$this is the pathname including directory path and design file name\$\$

\$DATE\$

\$TIME\$

District 02H Intersection Locations

TSI		Town	Parish	Route	Major St	Minor St	CS	Log Mile	GPS	ATC Controller
29	002	Thibodaux	Lafourche	LA 20	Jackson St	7th Street	065-05	1.24	0	1
29	003	Thibodaux	Lafourche	LA 20	Jackson St	10th Street	065-05	1.02	0	1
29	012	Raceland	Lafourche	LA 3199	LA 3199	LA 1	005-07	0.03	1	1
29	022	Cut Off	Lafourche	LA 1	W Main St	Cote Blanche Bridge	064-04	9.90	1	1
29	028	Mathews	Lafourche	LA 1	LA 1	LA 654 (old LA 364)	064-06	5.01	1	1
29	045	Mathews	Lafourche	LA 308	LA 308	LA 654 (old LA 364)	407-03	1.94	1	1
29	048	Thibodaux	Lafourche	LA 1	St. Mary St.	LA 3185 (W Thibodaux by-Pass Rd)	064-08	1.68	1	1
29	050	Thibodaux	Lafourche	LA 1	E 1st St	Audubon Street	064-07	13.48	1	1
29	051	Thibodaux	Lafourche	LA 308	E Bayou Rd	Audubon Drive	407-05	13.99	1	1
29	057	Bayou Blue	Lafourche	LA 3087	LA 3087	US 90	005-06	0.85	1	1
29	061	Bayou Blue	Lafourche	LA 3087	Prospect Blvd	LA 316 (Bayou Blue Rd)	412-02	5.41	1	1
29	064	Cut Off	Lafourche	LA 1	LA 1	LA 3161	064-04	10.15	1	1
55	041	Houma	Terrebonne	LA 311	Little Bayou Black Dr	LA 664 (St Charles St)	413-01	1.06	1	1
29	048	Thibodaux	Lafourche	LA 20	Park Ave	LA 648 (Percy Brown Rd)	065-04	14.41	1	1
55	064	Houma	Terrebonne	LA 182	LA 182	LA 315	005-05	5.13	1	1
55	067	Houma	Terrebonne	LA 3040	Martin Luther King Blvd/ Tunnel Blvd	Hollywood Road	065-30	3.75	1	1
55	072	Houma	Terrebonne	LA 57	Grand Cailou Rd	Moffet Road	246-01	2.23	0	1
55	076	Schriever	Terrebonne	LA 20	LA 20	Main Project Road	244-03	3.86	1	1
55	109	Chauvin	Terrebonne	LA 56	Little Caillou Rod	LA 58 (Sarah Rd)	247-03	3.95	1	1
55	110	Houma	Terrebonne	LA 3040	W. Tunnel Blvd	Corporate Drive	065-30	3.33	1	1
55	113	Houma	Terrebonne	LA 311	Little Bayou Black Dr	Mystic Boulevard	413-01	1.21	1	1
29	053	Galliano	Lafourche	LA 1	W. Main St	St. Joseph Bridge	064-04	3.78	1	1
29	040	Galliano	Lafourche	LA 308	E. Main St	E. 90th St	407-01	6.66	1	1
29	039	Galliano	Lafourche	LA 1	W. Main St	LA 3162/ LA 308 Spur	064-04	6.62	1	1
29	056	Cut Off	Lafourche	LA 308	E. Main St	LA 649 (New Cut Off Bridge)	407-90	0.00	1	1
29	055	Cut Off	Lafourche	LA 1	W. Main St	LA 649 (New Cut Off Bridge)	064-04	12.40	1	1
29	087	Larose	Lafourche	LA 308	Highway 308	Bayou Portuguese Dr	407-90	4.28	1	1
29	071	Larose	Lafourche	LA 1	Highway One	Adam Blvd	064-05	4.19	1	1

TRAFFIC
ENGINEERING



PROJECT LOCATIONS

DISTRICT 02H CONTROLLER UPGRADE



NO. DATE

REVISION DESCRIPTION

BY

DESIGNED
CHECKED
J. BONNETTE
A. FILLASTRE

PARISH
FEDERAL
PROJECT
HOI 1407

DISTRICT 02H

SHEET
NUMBER
20

\$\$\$this is the pathname including directory path and design file name\$\$\$

\$DATE\$

\$TIME\$

District 02H Intersection Locations

TSI	Town	Parish	Route	Major St	Minor St	CS	Log Mile	GPS	ATC Controller
55 005	Houma	Terrebonne	LA 182	Barrow St	LA 3040 (Bond St)	005-05	6.48	1	1
55 004	Houma	Terrebonne	LA 182	Barrow St	LA 3040 (Honduras St)	005-05	6.43	1	1
55 093	Houma	Terrebonne	LA 182	LA 182 (US 90 Branch)	LA 664 (St Charles St)	005-05	3.95	1	1
55 003	Houma	Terrebonne	LA 311	LA 311	LA 182 (US 90 Branch)	005-05	5.69	1	1
55 087	Houma	Terrebonne	LA 311	LA 311	S. Hollywood Rd	413-01	2.20	1	1
55 047	Houma	Terrebonne	LA 3040	LA 3040 (Tunnel Blvd)	LA 664 (St. Charles St)	885-12	0.54	1	1
55 094	Houma	Terrebonne	LA 3040	LA 3040 (Tunnel Blvd)	Polk St	065-30	2.43	1	1
55 110	Houma	Terrebonne	LA 3040	LA 3040 (Martin Luther King Blvd)	Enterprise Dr	065-30	4.34	1	1
55 111	Houma	Terrebonne	LA 3040	LA 3040 (Martin Luther King Blvd)	Savanne Rd	065-30	6.07	1	1
29 008	Thibodaux	Lafourche	LA 1	LA 1 (St. Mary St)	Tiger Dr	064-08	0.74	1	1
29 049	Thibodaux	Lafourche	LA 308	LA 308 (Bayou Rd)	Tiger Dr	407-05	0.74	1	1
29 005	Thibodaux	Lafourche	LA 1	LA 1 (St. Mary St)	Ridgefield Rd	064-08	0.26	1	1
29 007	Thibodaux	Lafourche	LA 20	LA 20 (Jackson St)	4th St	065-05	1.42	0	1
29 006	Thibodaux	Lafourche	LA 20	LA 20 (Jackson St)	LA 1 (W 1st St) Bridge	065-05	1.47	0	1
29 047	Thibodaux	Lafourche	LA 308	LA 308 (Bayou Rd)	LA 20 (St Patrick St) Bridge	065-05	1.54	0	1
29 067	Thibodaux	Lafourche	LA 20	LA 20 (Canal Blvd)	LA 3107 (Talbot Ave)	065-05	0.07	1	1
29 011	Raceland	Lafourche	LA 1	LA 1	Twin Oaks Drive	064-06	6.35	1	1

TRAFFIC ENGINEERING



PROJECT LOCATIONS



NO. DATE

ADDED ONE INTERSECTION

JMB

DESIGNED J. BONNETTE
CHECKED A. FILLASTRE
DATE 11/20/2014
SHEET 1 of 1

PARISH
DISTRICT 02H
FEDERAL PROJECT
HOI 1407
STATE PROJECT
H.OI 1407

SHEET NUMBER 2b



LOUISIANA DEPARTMENT OF
TRANSPORTATION & DEVELOPMENT

1/7/2015

Summary Of Estimated Quantities

Page: 3

Proposal ID: H.011407.6 State Project Number: H.011407

Federal Project Number: H011407

Proposal Description: District 02H Controller Upgrade

Item No.	Description	Supplemental Description	Alternate Set Member	Quantity	Units
General Items					
713-01-00100	Temporary Signs and Barricades			1.000	LUMP
727-01-00100	Mobilization			1.000	LUMP
736-08-00060	Sig Cntrlr (TS-2, Type 2, w/Eth cap)(Exis Cabinet) (F&I)			50.000	EACH
NS-736-00001	GPS			43.000	EACH

Notes:

SPAN WIRE SIGNAL INSTALLATION

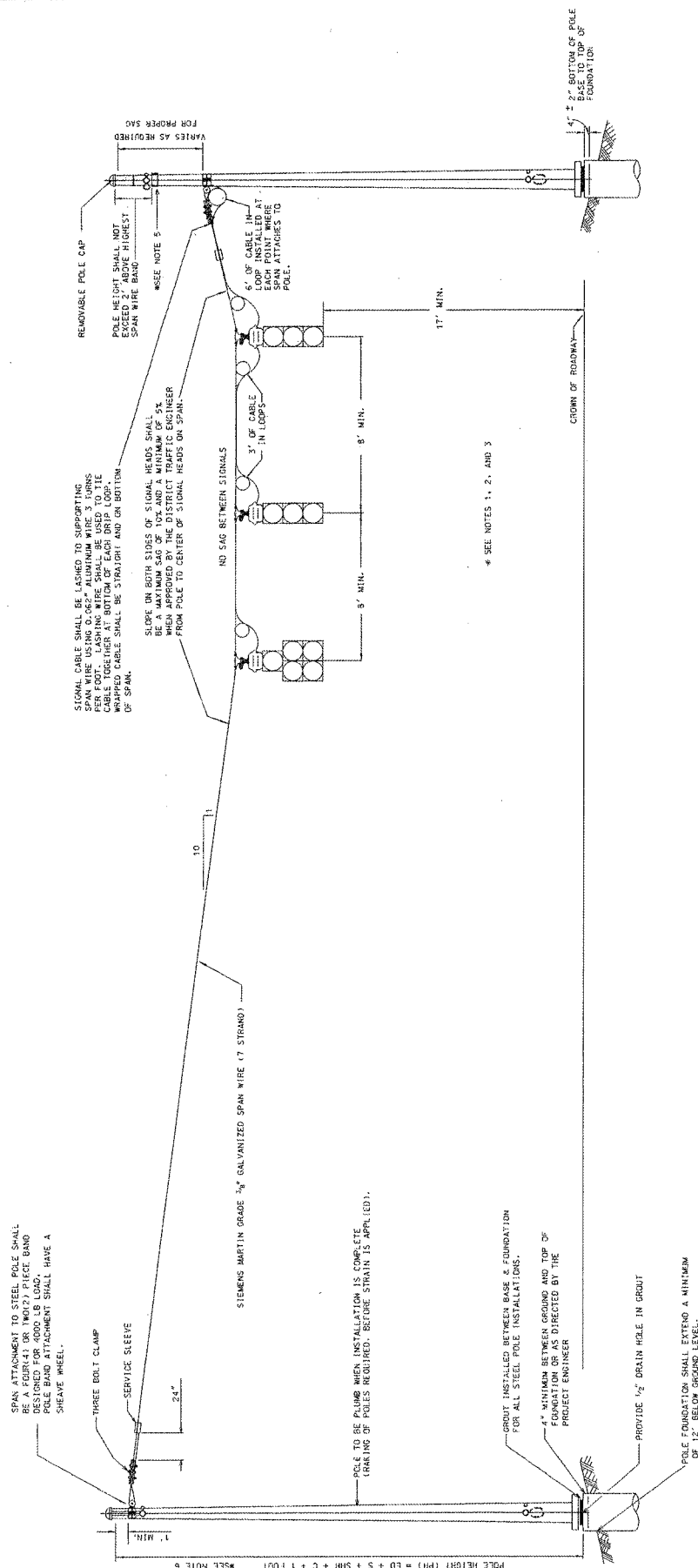
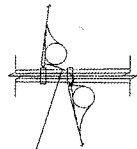
STEEL POLE INSTALLATION SHOWN. ALSO APPLIES TO WOOD POLE INSTALLATION.

LEGEND:

- ELEVATION DIFFERENCE BETWEEN ROADWAY & GRADE AT POLE BASE
- SAG AS ILLUSTRATED
- SIGNAL HEAD HEIGHT + SPAN WIRE ATTACHMENT AND DISCONNECT HANGER
- REQUIRED CLEARANCE 17' OR AS SPECIFIED
- POLE HEIGHT

ATTACH SIGNAL CABLE TO POLE WHEN POLE BANDS ARE MORE THAN 18" APART. USE NONCONDUCTING MATERIAL, HEAVY DUTY TIE WRAP SHALL BE 1/2" WIDE, SELF-LOCKING, ULTRA VIOLET, AND WEATHER RESISTANT. EXCESS WRAP MATERIAL SHALL BE TRIMMED.

ATTACH SIGNAL CABLE TO SPAN
ON BOTH SIDES OF LOOP.



NOTE:

1. REFER TO THE LADDITT SIGNAL DESIGN MANUAL FOR SIGNAL HEAD TYPE, NUMBER AND PLACEMENT. (SEE SECTION 21, FIGURES 1-15)
2. ALL SIGNAL HEADS SHALL BE 17" MINIMUM HEIGHT. REFER TO THE MUTCO CURRENTLY ADOPTED SPECIFICATION.
3. SPECIFIC APPROACH SHALL BE DETERMINED BY THE PROJECT ENGINEERS. OVER APPROACH, TURN LANE HEADS SHALL BE PLACED WITH ARCuate SPACING FROM LEFT MOST TURN LANE HEADS.
4. SIGNAL CABLE SHALL ENTER POLE BY WIRE MAY PROVIDED ON POLE. WEATHER HEAD SHALL BE PROVIDED TO THE NUMBER OF CABLES IN 3' GAPS PROVIDED WITH NECESSARY REDUCERS.
5. A SEPARATE POLE BAND MAY BE REQUIRED TO ATTACH PERPENDICULAR SPAN TO POLE MEETING THE REQUIREMENTS FOR SIGNAL HEIGHT AND SAC.
6. ALL PASSING MINIMUM SIGNAL POLE HEIGHT SHALL BE USED TO MEET THE 17' MINIMUM HEIGHT BEFORE CONSIDERING ANY OTHER ADJUSTMENTS TO THE FOUNDATION MAY BE APPROVED BY THE PROJECT ENGINEERS.



NOTES:

1. FORMS MUST BE APPROVED BY THE PROJECT ENGINEER BEFORE POURING CONCRETE INTO ANY FOUNDATION FORM OR BEFORE COVERING ANY CONJOINT.
2. TRAFFIC SIGNAL ANCHOR BOLTS SHALL PROTRUDE 2'-2" MIN. - 3" MAX. ABOVE FINISHED PEDESTAL FOUNDATION. CONJOINT AND GROUND RODS SHALL PROTRUDE 2" ABOVE FINISHED FOUNDATION.
3. BACKFILL OVER CONJOINT RUNS SHALL BE OF SOIL OR SAND AND SHALL NOT CONTAIN ROCKS OR CONCRETE.
4. ALL 30" ELLS TO BE STANDARD RADIUS.

SECTION A-A

[illegible]

NOTES:

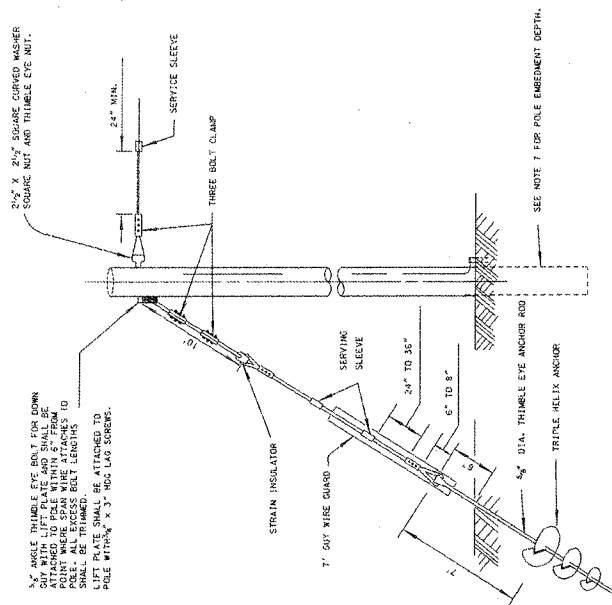
-
- CONDUIT SHALL BE INSTALLED ACCORDING TO PLANS. CONDUIT SHALL BE CENTERED IN THE FOUNDATION WITH SPACING.
 - STEEL PILE FOUNDATIONS TO HAVE ALL SPARE STEEL PILES CUT OFF 24\"/>
 - TOP OF BASE SHALL BE ROUNDED WITH CHAMFERED EDGE.
 - SERVICE CONDUIT SHALL BE 2\"/>
 - WHERE DIAMETER NOT SPECIFIED, USE 28\"/>
 - USE A GROUND ROD CLAMP TO ATTACH THE #6 GROUND ROD TO THE CONDUIT. THE OTHER END OF THE POLE.
 - SEE SHEET 13D-02 FOR ANCHOR BOLT DETAIL.
 - ALL GROUND RODS, REGARDLESS OF FOUNDATION SIZE SHALL BE WELDED TO THE PILE FOUNDATION AND 4\"/>
- 5/8\"/>

GROUND RODS SPLICED TOGETHER IN A MANNER WHICH IS (U.L.)

UNDERWRITERS LABORATORY APPROVED.

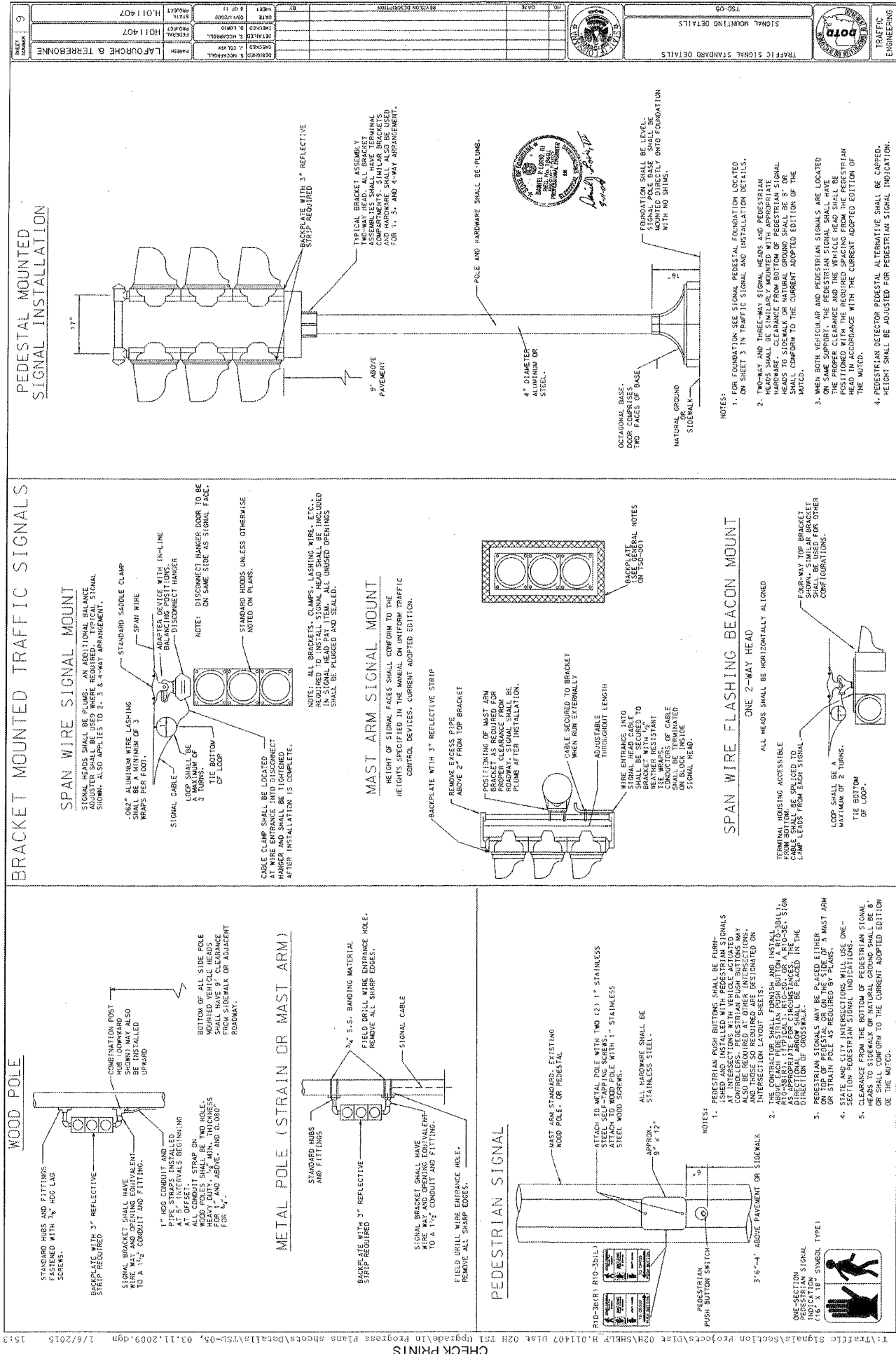


WOOD POLE DETAIL

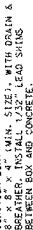


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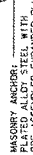
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EXPANSION FITTING: BONDING STRAP, S.S. HARDWARE, DRILL 1/8" N
GRAIN HOLE IN BOTTOM OF FITTING. (FITTINGS ARE REQUIRED AT
ALL EXPANSION JOINTS)



S.S. HEX. HEAD MACHINE BOLT WITH
S.S. FLAT WASHER AND S.S. LOCK



1. CLAMP, CLAMP BACK AND NEST BACK SHALL BE PRODUCTS OF THE SAME MANUFACTURER.

ALSO USED ON BRIGLE SPAN INSTALLATION



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FREE END INSTALL AS SHOWN

- NOTES:
1. A
 2. A

5/8" X 1-1/2" EP L BOLT
(2 PLACES)

- 1.



Daniel J. Love, III

PEDESTAL-MOUNTED SIGNAL SERVICE POLE INSTALLATION

NOTE: PEDESTAL-MOUNTED SIGNAL SERVICE POLE SHALL BE CAPPED.

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ELECTRICAL SERVICE DISCONNECT RAIN TIGHT ENCLOSURE FOR PEDESTAL MOUNTED SIGNAL SERVICE POLE

NOTE: ENCLOSURE SHALL BE CAPPED.

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OVERHEAD SERVICE TO CONTROLLER

(AS CALLED FOR IN THE PLANS OR APPROVED BY PROJECT ENGINEER)

NOTE: SERVICE CLAMPS FOR DISCONNECT CABLE, NO MESSENGER CABLE REQUIRED.

NOTE: SERVICE CLAMPS FOR DISCONNECT CABLE, NO MESSENGER CABLE REQUIRED.

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NOTES:

- SEE NOTE CONCERNING ASPHALTIC SHOULDERS.

SEE NOTE CONCERNING ASPHALTIC SHOULE

SEE TYPICAL LOOP LEAD-IN INSTALLATION FOR TERMINATION.

SEE TYPICAL LOOP LEAD-IN INSTALLATION FOR TERMINATION.

SEE TYPICAL LOOK-
FOR TERMINATION.

PVC SCH. 80 CONDUIT.
NOTE CONCERNING
ALTYC SHOULDERS.

AS CALLED FOR ON PLANS
OR 10' FROM RIGHT EDGE
OF TRAVEL LANE

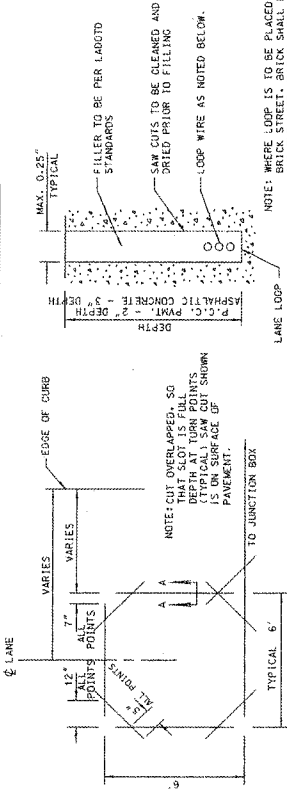
PAVEMENT JOINT & CRACK SECTION

NOTES



NOTE: DROP SAW BLADE DOWN TO ALLOW SLACK IN CABLE FOR A JOINT LESS THAN 1". ALL OTHER JOINTS SHALL NOT BE CROSSED EXCEPT AS DIRECTED BY ENGINEER.

Φ LANE



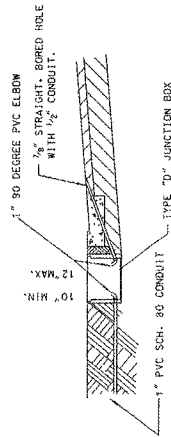
CENTERED IN LANE.

NOTE: SAW CUTS DO NOT MEET AT CORNER OF RECTANGLE. DIMENSIONS SHOWN ARE REQUIRED FOR USING 12" SAW BLADE. LARGE BLADES REQUIRE LONGER DISTANCES THAN SHOWN AT CORNERS. CONTRACTOR IS RESPONSIBLE FOR MAINTAINING CORRECT DEPTH REGARDLESS OF BLADE SIZE, UNLESS OTHERWISE NOTED IN PLANS.

SECTION A-A

NOTE: WHERE LOOP IS TO BE PLACED IN BRICK STREET, BRICK SHALL BE TAKEN UP AND WIRE LOOPS PLACED BELOW THE BRICKS. STRIPS SHALL BE TO BE GRASPED BETWEEN BRICK AND KITCHEN BRICK SHALL BE REPLACED TO ORIGINAL GRADE UPON COMPLETION OF LOOP WIRE PLACEMENT.

TYPICAL LOOP LEAD-IN INSTALLATION



NOTE: TYPE 0 12"x12"x13" FOOTED
JUNCTION BOX, H-10 LOAD.
INSTALL WHERE SIDEWALKS
ARE EXISTING.

7/8" STRAIGHT, BORED HOLE
WITH 1/2" CONDUIT.

CONDUIT SHALL BE SE...
AT SAWCUT WITH DUC...
THEN LOOP SEALANT.

CURB

CONDUIT FROM RA
ENTER JUNCTION
SIDE OR BOTTOM

NOTES:

1. CONTRACTOR SHALL PROVIDE 1/2" CONDUIT FROM JUNCTION BOX AND TERMINATE BELOW GROUND SO THAT IT DIRECTLY RECEIVES LOOP LEAD-IN WIRE.
2. FOR A LOOP INSTALLATION IN PAVEMENT WITH OVERLAYS LESS THAN 3" OVER CONCRETE, A DEEPER DEPTH SAWCUT SHALL BE REQUIRED. THE DEPTH REQUIRED SHALL PRECEDE A 1" SAW CUT INTO THE JOBSITE AND SAW CUT SHALL BE TERMINATED BY THE PROJECT ENGINEER PRIOR TO THE WIRE INSTALLATION.
3. FOR LOOP INSTALLATIONS IN ROADWAY THAT HAS ASPHALT SURFACING, THE WIRE SHALL BE EXTENDED THROUGH A TRENCH IN THE SHOULDER TO A JUNCTION BOX INSTALLED OUTSIDE THE SHOULDER.
4. IDENTIFY LOOP WIRES WITH PERMANENT LABEL MARKED WITH CONTROLLER PHASE.
5. LOOP SPlice SHALL BE MADE WITH A COPPER OPEN ENDED COMPRESSION SPlice CAP AND CRIMPED. THE LOOP SPlice SHALL THEN BE SEALED WITH A HOT-CAST EPOXY ELECTRICAL INSULATING RESIN SYSTEM OR A APPROVED EQUAL.

STATE OF LOUISIANA
DANIEL J. LORIO, MI
REG. NO. 16861
REGISTERED
PROFESSIONAL
ENGINEER
IN
ELECTRICAL ENGINEERING

Daniel J. Lorio, Jr.

* NOTE FOR TYPE G-10: 1. AND J JUNCTION BOXES: 2. THE WALL OF BOX, 5.638" FROM THE TOP OF EACH BOX. 3. TWO PIECES OF ALUMINUM OR STEEL FIBERED CHANNEL 1" LONG TO BE SUPPLIED WITH EACH BOX. 4. BELTS TO BE 1/2" x 3/4" LONG STAINLESS STEEL 1/4" SPACERS TO BE PLACED BETWEEN CHANNELS TO ALLOW FOR UNIFORM TENSION BOX. 5. PRODUCTS WITH FIBER OPTIC COMMUNICATION: INSTALL A MINIMUM OF 50' SPARE FIBER IN TYPE G-60 AND 100' SPARE FIBER IN LARGER JUNCTION BOXES.

**STATE OF LOUISIANA
DEPARTMENT OF TRANSPORTATION AND
DEVELOPMENT**



**CONSTRUCTION PROPOSAL
INFORMATION
FOR**

FEDERAL AID PROJECT

**STATE PROJECT NO. H.011407
DISTRICT 02H CONTROLLER UPGRADE
TERREBONNE AND LAFOURCHE PARISHES**

BID BOND

A Bid Bond is required when the bidder's total bid amount as calculated by the Department in accordance with Subsection 103.01 is greater than \$50,000. (*See Section 102 of the Project Specifications.*)

_____, as Principal (Bidder)
and _____, as Surety,
are bound unto the State of Louisiana, Department of Transportation and Development, (hereinafter called the Department) in the sum of five percent (5%) of the bidder's total bid amount as calculated by the Department for payment, of which the Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, as solidary obligors.

Signed and sealed this _____ day of _____, 20_____.

The condition of this obligation is such that, whereas the Principal has submitted a bid to the Department on a contract for the construction of **STATE PROJECT NO. H.011407, FEDERAL AID PROJECT NO. H011407, DISTRICT 02H CONTROLLER UPGRADE, located in TERREBONNE AND LAFOURCHE PARISHES**, if the bid is accepted and the Principal, within the specified time, enters into the contract in writing and gives bond with Surety acceptable to the Department for payment and performance of said contract, this obligation shall be void; otherwise to remain in effect.

_____ Principal (Bidder or First Partner to Joint Venture)	_____ If a Joint Venture, Second Partner
By _____	By _____
Authorized Officer-Owner-Partner	Authorized Officer-Owner-Partner
_____ Typed or Printed Name	_____ Typed or Printed Name

_____ Surety	
By _____	(Seal)
Agent or Attorney-in-Fact	
_____ Typed or Printed Name	

To receive a copy of the contract and subsequent correspondence / communication from LA DOTD, with respect to the bid bonds, the following information must be provided:

_____ Bonding Agency or Company Name	_____ Address
_____ Agent or Representative	_____ Phone Number / Fax Number



Proposal Schedule of Items

Page 1 of 1

Proposal ID: H.011407.6

Project(s): H.011407.6

SECTION: 1

General Items

Proposal Line Number	Item ID	Description Unit Price (In Words, Ink or Typed)	Approximate Quantity	Unit of Measure
0001	713-01-00100	Temporary Signs and Barricades		LUMP SUM
				Dollars
				Cents
0002	727-01-00100	Mobilization		LUMP SUM
				Dollars
				Cents
0003	736-08-00060	Sig Cntrlr (TS-2, Type 2, w/Eth cap)(Exis Cabinet) (F&I)	50.000	EACH
				Dollars
				Cents
0004	NS-736-00001	GPS	43.000	EACH
				Dollars
				Cents

Section: 1

Total: _____

Total Bid: _____

CONSTRUCTION PROPOSAL SIGNATURE AND EXECUTION FORM

THIS FORM, THE SCHEDULE OF ITEMS, AND THE PROPOSAL GUARANTY MUST BE COMPLETED AS INDICATED AND SUBMITTED TO THE LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT (DOTD) TO CONSTITUTE A VALID BID

STATE PROJECT NO.

H.011407

FEDERAL AID PROJECT NO.

H011407

NAME OF PROJECT

DISTRICT 02H CONTROLLER UPGRADE

I (WE) HEREBY CERTIFY THAT I (WE) HAVE CAREFULLY EXAMINED THE PROPOSAL, PLANS AND SPECIFICATIONS, INCLUDING ANY AND ALL ADDENDA, AND THE SITE OF THE ABOVE PROJECT AND AM (ARE) FULLY COGNIZANT OF ALL PROPOSAL DOCUMENTS, THE MASTER COPY OF WHICH IS ON FILE AT DOTD HEADQUARTERS IN BATON ROUGE, LA., AND ALL WORK, MATERIALS AND LABOR REQUIRED THEREIN, AND AGREE TO PERFORM ALL WORK, AND SUPPLY ALL NECESSARY MATERIALS AND LABOR REQUIRED FOR SUCCESSFUL AND TIMELY COMPLETION OF THE ABOVE PROJECT AND TO ACCEPT THE SUMMATION OF THE PRODUCTS OF THE UNIT PRICES BID ON THE SCHEDULE OF ITEMS ATTACHED HERETO AND MADE A PART HEREOF MULTIPLIED BY THE ACTUAL QUANTITY OF UNIT OF MEASURE PERFORMED FOR EACH ITEM, AS AUDITED BY DOTD, AS FULL AND FINAL PAYMENT FOR ALL WORK, LABOR AND MATERIALS NECESSARY TO COMPLETE THE ABOVE PROJECT, SUBJECT TO INCREASE ONLY FOR PLAN CHANGES (CHANGE ORDERS) APPROVED BY THE DOTD CHIEF ENGINEER OR HIS DESIGNEE. THIS BID IS SUBMITTED IN ACCORDANCE WITH THE GENERAL BIDDING REQUIREMENTS IN THE CONSTRUCTION PROPOSAL AND ALL SPECIAL PROVISIONS, PLANS, SUPPLEMENTAL SPECIFICATIONS, AND THE LOUISIANA STANDARD SPECIFICATIONS FOR ROADS AND BRIDGES (2006 EDITION). I (WE) UNDERSTAND THAT THE SUMMATION OF THE PRODUCTS OF THE UNIT PRICES BID ON THE SCHEDULE OF ITEMS MULTIPLIED BY THE ESTIMATED QUANTITY OF UNIT OF MEASURE FOR EACH ITEM, ALONG WITH ANY OTHER FACTORS SPECIFIED TO BE APPLICABLE SUCH AS CONSTRUCTION TIME AND/OR LANE RENTAL, SHALL BE THE BASIS FOR THE COMPARISON OF BIDS. I (WE) UNDERSTAND THAT THE SCHEDULE OF ITEMS MUST CONTAIN UNIT PRICES WRITTEN OUT IN WORDS AND THAT THE SCHEDULE OF ITEMS SUBMITTED AS PART OF THIS BID IS ON THE FORM SUPPLIED BY DOTD IN THE BID PROPOSAL. MY (OUR) PROPOSAL GUARANTY IN THE AMOUNT SPECIFIED FOR THE PROJECT IS ATTACHED HERETO AS EVIDENCE OF MY (OUR) GOOD FAITH TO BE FORFEITED IF THIS BID IS ACCEPTED BY DOTD AND I (WE) FAIL TO COMPLY WITH ANY REQUIREMENT NECESSARY FOR AWARD AND EXECUTION OF THE CONTRACT, AS WELL AS, SIGN AND DELIVER THE CONTRACT AND PAYMENT/PERFORMANCE/RETAINAGE BOND AS REQUIRED IN THE SPECIFICATIONS.

NONCOLLUSION DECLARATION (APPLICABLE TO FEDERAL-AID PROJECTS)

I (WE) DECLARE UNDER PENALTY OF PERJURY UNDER THE LAWS OF THE UNITED STATES AND THE STATE OF LOUISIANA THAT I (WE) HAVE NOT DIRECTLY OR INDIRECTLY, ENTERED INTO ANY AGREEMENT, PARTICIPATED IN ANY COLLUSION, OR OTHERWISE TAKEN ANY ACTION IN RESTRAINT OF FREE COMPETITIVE BIDDING IN CONNECTION WITH THE CONTRACT FOR THIS PROJECT NOR VIOLATED LA. R.S. 48:254.

BIDDER'S DBE GOAL STATEMENT (APPLICABLE TO DBE GOAL PROJECTS)

IF THIS PROJECT IS DESIGNATED BY SPECIAL PROVISION AS A DISADVANTAGED BUSINESS ENTERPRISE (DBE) GOAL PROJECT IN ACCORDANCE WITH THE DBE PROVISIONS OF THIS CONTRACT, THE BIDDER ASSURES DOTD THAT HE/SHE WILL MEET OR EXCEED THE DBE CONTRACT GOAL, OR IF THE BIDDER CANNOT MEET THE REQUIRED DBE GOAL, THE BIDDER ASSURES DOTD THAT HE/SHE HAS MADE AND CAN DOCUMENT GOOD FAITH EFFORTS MADE TOWARDS MEETING THE GOAL REQUIREMENT IN ACCORDANCE WITH THE CONTRACT AND DBE PROGRAM MANUAL INCORPORATED HEREIN BY REFERENCE.

THE APPARENT LOW BIDDER SHALL COMPLETE AND SUBMIT TO THE DOTD COMPLIANCE PROGRAMS OFFICE, FORM CS-6AAA AND ATTACHMENT(S) AND, IF NECESSARY, DOCUMENTATION OF GOOD FAITH EFFORTS MADE BY THE BIDDER TOWARD MEETING THE GOAL, WITHIN TEN BUSINESS DAYS AFTER THE OPENING OF BIDS FOR THIS PROJECT. RESPONSIVENESS OF INFORMATION SUPPLIED IN THIS SECTION OF THIS CONSTRUCTION PROPOSAL SIGNATURE AND EXECUTION FORM IS GOVERNED BY THE DBE REQUIREMENTS INCLUDED WITHIN THE SPECIFICATIONS AND DBE PROGRAM MANUAL.

CERTIFICATION OF EMPLOYMENT OF LOUISIANA RESIDENTS TRANSPORTATION INFRASTRUCTURE MODEL FOR ECONOMIC DEVELOPMENT (TIME) PROJECTS (APPLICABLE TO TIME PROJECTS)

IF THIS PROJECT IS DESIGNATED BY SPECIAL PROVISION AS A TRANSPORTATION INFRASTRUCTURE MODEL FOR ECONOMIC DEVELOPMENT (TIME) PROJECT AS DEFINED IN ACT NO. 16 OF THE 1989 FIRST EXTRAORDINARY SESSION OF THE LEGISLATURE WHICH ENACTED PART V OF CHAPTER 7 OF SUBTITLE II OF TITLE 47 OF THE LOUISIANA REVISED STATUTES OF 1950, COMPRISED OF R.S. 47:820.1 THROUGH 820.6.

THE BIDDER CERTIFIES THAT AT LEAST 80 PERCENT OF THE EMPLOYEES EMPLOYED ON THIS TIME PROJECT WILL BE LOUISIANA RESIDENTS IN ACCORDANCE WITH LOUISIANA R.S. 47:820.3.

NON PARTICIPATION IN PAYMENT ADJUSTMENT (ASPHALT CEMENT AND FUELS) STATEMENT

IF THIS PROJECT IS DESIGNATED BY SPECIAL PROVISION AS BEING SUBJECT TO PAYMENT ADJUSTMENT FOR ASPHALT CEMENT AND/OR FUELS, THE BIDDER HAS THE OPTION OF REQUESTING EXCLUSION FROM SAID PAYMENT ADJUSTMENT PROVISIONS THAT ARE ESTABLISHED BY SPECIAL PROVISION ELSEWHERE HEREIN.

IF THE BIDDER DESIRES TO BE EXCLUDED FROM THESE PAYMENT ADJUSTMENT PROVISIONS,

THE BIDDER IS REQUIRED TO MARK HERE

☐

FAILURE TO MARK THIS BOX PRIOR TO BID OPENING WILL CONSTITUTE FORFEITURE OF THE BIDDER'S OPTION TO REQUEST EXCLUSION.

CS-14A
08/06

STATE PROJECT NO. H.011407

BIDDER SIGNATURE REQUIREMENTS (APPLICABLE TO ALL PROJECTS)

THIS BID FOR THE CAPTIONED PROJECT IS SUBMITTED BY:

(Name of Principal (Individual, Firm, Corporation, or Joint Venture))

(If Joint Venture, Name of First Partner)

(Louisiana Contractor's License Number of Bidder or First Partner to Joint Venture)

(Business Street Address)

(Business Mailing Address, if different)

(Area Code and Telephone Number of Business)

(Telephone Number and Name of Contact Person)

(Telecopier Number, if any)

(If Joint Venture, Name of Second Partner)

(Louisiana Contractor's License Number of Second Partner to Joint Venture)

(Business Street Address)

(Business Mailing Address, if different)

(Area Code and Telephone Number of Business)

(Telephone Number and Name of Contact Person)

(Telecopier Number, if any)

ACTING ON BEHALF OF THE BIDDER, THIS IS TO ATTEST THAT THE UNDERSIGNED DULY AUTHORIZED REPRESENTATIVE OF THE ABOVE CAPTIONED FIRM, CORPORATION OR BUSINESS, BY SUBMISSION OF THIS BID, AGREES AND CERTIFIES THE TRUTH AND ACCURACY OF ALL PROVISIONS OF THIS PROPOSAL, INCLUSIVE OF THE REQUIREMENTS, STATEMENTS, DECLARATIONS AND CERTIFICATIONS ABOVE AND IN THE SCHEDULE OF ITEMS AND PROPOSAL GUARANTY. EXECUTION AND SIGNATURE OF THIS FORM AND SUBMISSION OF THE SCHEDULE OF ITEMS AND PROPOSAL GUARANTY SHALL CONSTITUTE AN IRREVOCABLE AND LEGALLY BINDING OFFER BY THE BIDDER.

(Signature)

(Printed Name)

(Title)

(Date of Signature)

(Signature)

(Printed Name)

(Title)

(Date of Signature)

CONTRACTOR'S TOTAL BASE BID \$ _____

IT IS AGREED THAT THIS TOTAL, DETERMINED BY THE BIDDER, IS FOR PURPOSES OF OPENING AND READING BIDS ONLY, AND THAT THE LOW BID FOR THIS PROJECT WILL BE DETERMINED FROM THE EXTENSION AND TOTAL OF THE BID ITEMS BY DOTD.

CS-14AA
08/06